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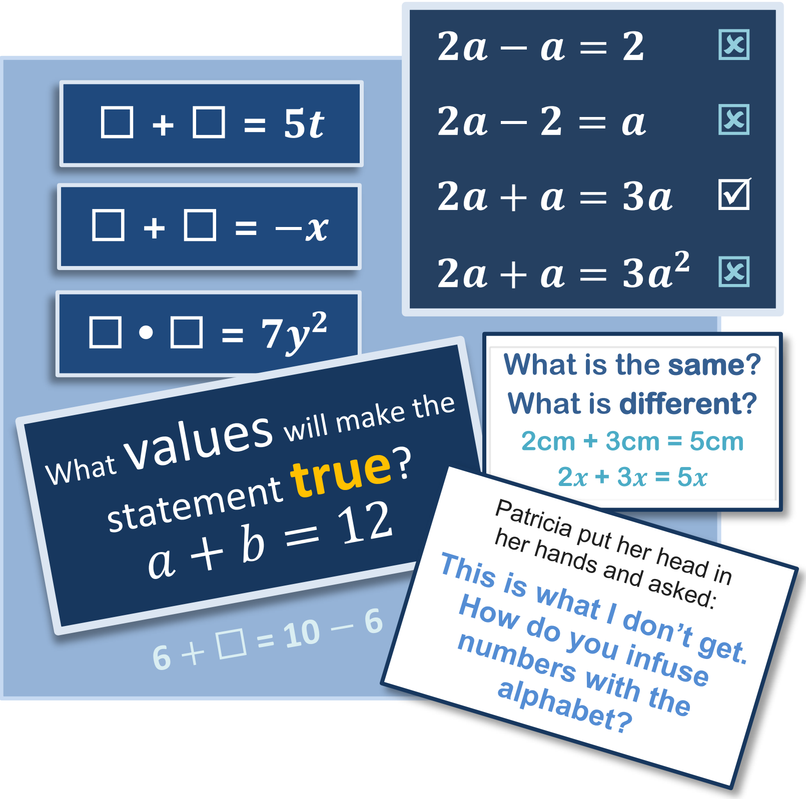
x.act

PRACTICE IN SIMPLIFYING ALGEBRAIC EXPRESSIONS

VERSION 1.0

Grade 8



☐ + ☐ = $5t$

☐ + ☐ = $-x$

☐ • ☐ = $7y^2$

$2a - a = 2$ ☒

$2a - 2 = a$ ☒

$2a + a = 3a$ ☑

$2a + a = 3a^2$ ☒

What values will make the statement true?
$a + b = 12$

$6 + \square = 10 - 6$

What is the same?
What is different?
2cm + 3cm = 5cm
$2x + 3x = 5x$

Patricia put her head in her hands and asked:
This is what I don't get. How do you infuse numbers with the alphabet?

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FIRSTRAND
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science & innovation
Department: Science and Innovation
REPUBLIC OF SOUTH AFRICA

x.act: Practice in simplifying algebraic expressions

These materials were produced by the Wits Maths Connect Secondary (WMCS) project at the University of the Witwatersrand.
Visit us at www.witsmathsconnectsecondary.co.za

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PRACTICE IN SIMPLIFYING ALGEBRAIC EXPRESSIONS

VERSION 1.0

About this booklet

The 31 worksheets in this booklet provide practice in simplifying algebraic expressions – a critical skill in introductory algebra at Grade 8 level. The worksheets also include answers for each question.

The pack is called x.act for two reasons: algebra requires you to *act* and algebra requires you to be *exact*. To become good at algebra, you have to make sense of operating on letters, to show determination in getting used to new symbols, and to practise regularly. You also need to pay attention to the structure of algebraic expressions. In this pack we pay attention to all these issues.

We assume learners have been taught the content of introductory algebra so that they can use these worksheets to practise algebraic simplification. We provide a 7-page summary of the basics of simplifying algebraic expressions where we explain important concepts, terminology, notation and procedures with illustrative examples. We also include some discussion on what makes algebra confusing and what must be done to overcome these difficulties. We have written this summary in simple language for Grade 8 learners.

Our research in South African schools shows that learners have particular difficulty when algebraic expressions involve subtraction and negatives. They also struggle when expressions contain brackets. We developed the worksheets with these issues in mind. Some worksheets focus first on addition and positives before extending to negatives and subtraction. We also draw specific attention to the meaning of brackets in expressions. We encourage learners to look carefully at expressions before they rush to simplify them. This encourages them to pay attention to the structure of expressions – to notice what operations are being performed between terms, and to see the impact of minor variations between examples. Here is one such task:

In which expressions:

a) can you simplify terms outside the bracket before you deal with the bracket?

b) are the brackets unnecessary?

c) are you required to apply the distributive law?

$5x(6+x)$

$5+x+(1-x)$

$5+x(1-x)$

$x-x(6+x)$

$x-x+(6+x)$

$1+5-6(1+x)$

The worksheets are arranged in 4 sections as outlined below. Almost all worksheets were designed in pairs so that learners can work on 2 very similar worksheets, covering the same content and with very similar question types.

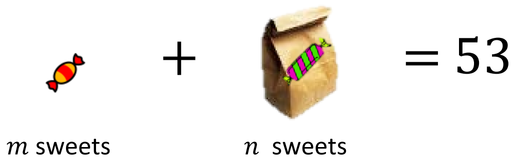
Section	#Wksts	Content
1	8	Distinguishing like and unlike terms, simplifying simple algebraic expressions, matching verbal and algebraic expressions, and using substitution to test whether expressions have been simplified correctly.
2	3	Evaluating simple algebraic expressions to emphasise that a letter can stand for a single number, and sometimes it can stand for many numbers.
3	10	Applying the distributive law, with particular attention to multiplying monomials by binomials.
4	10	Sets of mixed examples with several terms, different uses of brackets and more difficult examples that include the distributive law.

NOTES ON INTRODUCTORY ALGEBRA

In these notes we explain important concepts, terminology and notation in introductory algebra. We also provide examples to illustrate these. We have written these notes in simple language for Grade 8 learners. After the notes we discuss some instances where algebraic notation can be confusing.

1) Using variables in algebra

In algebra we use letters and numbers to represent quantities. We combine these with other symbols to represent the *relationships between* these quantities. For example, say we have 2 packets of sweets and we know that altogether there are 53 sweets.



If we say the number of sweets in the small packet is m and the number of sweets in the large packet is n, then the relationship can be expressed in algebra as $m + n = 53$. We say $m + \ n$ is an *algebraic expression* and we say that $m + n = 53$ is an *algebraic equation.* We can also refer to $m + n = 53$ as an *algebraic statement.*

In primary school we use a place holder, ☐, or a "space", __, to represent an unknown value, e.g. ☐ $+ 6 = 15$ and ___ $- 5 = 2$. In high school we use letters, e.g. $x + 6 = 15$ and $a - 5 = 4$. We can even have two letters in a statement, e.g. $a - 5 = b$.

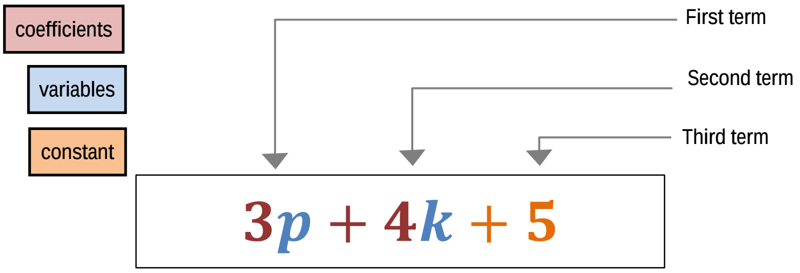
Sometimes the letter has only *one* value that will make the statement true. In $x + 6 = 15$, the statement will only be true if $x = 9$. Sometimes the variable can have *more than one* value. In $a - 5 = b$, the value of a affects the value of b. So, once we know the value of a, we can work out a value of b. Here are some possible combinations of a and b: $a = 12$ and $b = 7$; $a = 6$ and $b = 1$; $a = 5$ and $b = 0$; $a = 4$ and $b = -1$; $a = 6\frac{1}{2}$ and $b = 1\frac{1}{2}$. As you can see, the b-values can be worked out using substitution, e.g. if $a = 12$ then $b = 12 - 5 = 7$. If we know the b-value, then we can calculate the a-value, e.g. if $b = 3$, then $a = 8$; if $b = 7$, then $a = 12$. In all these examples we have shown that letters stand for numbers.

In the example with the sweets we have the algebraic equation (or statement): $m + n = 53$. If there are 20 sweets in the small packet then there must be 33 sweets in the large packet. This means $m = 20$ and $n = 33$. If there are 15 sweets in the small packet, how many sweets will there be in the large packet: $m =$ ___ and $=$ ___ ? As you can imagine, m and n can have many different values but, in this case, they will always be whole numbers because we don't talk about a negative number of sweets or a fraction of a sweet.

2) Naming the components of an algebraic expression

Algebraic expressions are made up of *terms.* Each term contains letters or numbers or both. Terms are separated by the operations of addition or subtraction. Consider the algebraic expression $3p + 4k + 5$. It consists of 3 terms which can be listed as $3p$; $4k$; 5.

The arrows indicate the separate terms.



- The letters are called *variables* because their values can change. In the example, variables are p and k. See colour coding in the diagram.
- Numbers that are multiplied by variables are called *coefficients*. In the example, the coefficient of p is 3 and the coefficient of k is 4. Mathematicians write the numbers before the letters, like $3p$ and $4k$. It is not wrong to write $p3$ but the convention is to write the numbers first. If the coefficient of a variable is $+1$ or -1, we don't write the 1 (see example below).
- Numbers without a variable are called *constants* because their value does not change. In the example, the constant is 5.

Here is another example: $-2x + y - 1$

This example has 3 terms: $-2x$; y and -1

The variables are x and y

The coefficient of x is -2, the coefficient of y is $+1$

The constant is -1

Refer to No. 7a for more details on expressions that involve subtraction and have negative coefficients and constants.

3) Describing algebraic expressions in words

Algebraic expressions can be described in words. We will call these *verbal expressions*. For example, if we have the algebraic expression $3x + 5$, we can create several verbal expressions that are slightly different. Here are four examples:

- The product of 3 and a number increased by 5
- The product of 3 and x increased by 5
- The product of 3 and x, add 5
- $3x$ add 5

We can also start with the verbal expression and then create the algebraic expression. For example, "the sum of 7 and a number, then multiplied by 2" can be written algebraically as $(7 + n) \times 2$. Usually we will write it as $2(7 + n)$ or $2(n + 7)$. We know that addition is commutative, that is $n + 7$ is the same as $7 + n$ so they are written interchangeably.

Here are 3 more examples of algebraic and their equivalent verbal expressions:

Algebraic expression	**Examples of verbal expressions**
$3p + 4k + 5$	• The product of 3 and p, add to the product of 4 and k, then add 5 • Three p add four k add 5
$3p - 6 + (-2)$	• The product of 3 and p, subtract 6 add negative 2 • $3p$ subtract 6 add negative 2
$x^2 - x + 2$	• A number squared subtract that number, then add 2 • A number squared subtract itself and add 2

4) The language of operations and signs

In the worksheets we make a clear distinction between operations and signs. We do not use the words *plus* and *minus* because they don't tell us whether we are referring to a sign or an operation. Pay attention to this in the following examples:

For operations, we say:	***add*** and ***subtract***	$5+8$	5 add 8
		$10-4$	10 subtract 4
For signs, we say:	***positive*** and ***negative***	$-4-3$	negative 4 subtract 3
		$-4-(+3)$	negative 4 subtract positive 3
		$4-(-3)$	4 subtract negative 3
		$4+(-3)$	4 add negative 3

Sometimes we talk about the *plus symbol* $(+)$ and the *minus symbol* $(-)$. When we do this, we are referring only to the symbol. We are not referring to its meaning as a sign or an operation. For example, in $4+(-3)$ the plus symbol $(+)$ tells us to add and the minus symbol $(-)$ tells us that 3 is negative. Refer to No. 7a for more details on expressions that involve subtraction and negatives.

5) Like and unlike terms

In algebra there are two interesting words: *like* and *unlike*. Both words are familiar on social media but they have different meanings in maths to their use on social media!!
In maths we use them when we refer to terms. We speak of *like terms* and *unlike terms*.

Like terms have the same (i.e. like) variables with the same (i.e. like) exponents for the variables.
Unlike terms have different variables or different exponents even if they have the same variables.

Like terms	**Notes**
$k\ +\ 3k$	Same variable k, same exponent 1
$5a-7a$	Same variable a, same exponent 1
$3x+7x$	Same variable x, same exponent 1
x^2-2x^2	Same variable x, same exponent 2
$5ab+2ba$	Same variables and exponents – it does not matter that the order of the variables is different because multiplication is commutative

Unlike terms	**Notes**
$3+3k$	Term with variable and term with constant
$5a-7b$	Two different variables
$3x+7x^2$	Same variable but different exponents
k^3-x^3	Same exponents but different variables
$7k-7x$	Two different variables (does not matter that coefficients are the same)
$5ab+2b+7a$	3 terms don't have same combination of variables

6) Operating on like and unlike terms

a) Adding and subtracting terms

We can add and subtract like terms. We cannot add and subtract unlike terms. We speak of *collecting like terms* which means we add or subtract the like terms to get a simpler answer.

Expressions can be simplified by adding or subtracting because they contain like terms	Expressions cannot be simplified by adding or subtracting because there are no like terms	Expressions can be partly simplified because they have some like terms
$2a+3a=5a$	$2a+3b$	$2a+b+7b=2a+8b$
$2a+a=3a$	$2a-2b$	$2a+2b-2a+3b=5b$
$5k-3k=2k$	$2a-2$	$2a-2-a=a-2$
$p+p=2p$	$a+4$	$a+4+a-3=2a+1$
$2p-p=p$	$3a^2-3a-3$	$3a^2-a^2-3=2a^2-3$
$4a^2+6a^2=10a^2$	$5a-2ab$	$ab+ba+a^2b=2ab+a^2b$
$m-5m=-4m$		

b) Multiplying terms

- We can multiply like and unlike terms
- When we multiply letters, we use the addition law of exponents:

  When we multiply powers with the same base, then we add the exponents
- Here are some examples:

$5p \times 4 = 20p$	$5p^3 \times 4p = 20p^{3+1} = 20p^4$
$5p \times (-4) = -20p$	$5a \times 4b = 20ab$
$p \times p = p^{1+1} = p^2$	$5a \times 4ab = 20a^2b$

c) Dividing terms

- We can divide like and unlike terms
- When we divide terms with variables, we use the subtraction law of exponents:

  When we divide powers with the same base, then we subtract the exponents
- Here are some examples (assume the denominators are not zero):

$\frac{12p}{4} = 3p$	$\frac{12p^3}{3p} = 4p^{3-1} = 4p^2$
$\frac{12p^2}{-4} = -3p^2$	$\frac{6ab}{2b} = 3a$

d) Distributive law

We apply the distributive law when we multiply a monomial by an expression containing two or more unlike terms. A monomial consists of one term, e.g. $7a$; $2a^2$; $6ab$; 12. In Grades 8 and 9 you will often encounter binomials (e.g. $x + 3$ and $2m - 5$) and trinomials (e.g. $2a + 3b - 4c$).

We need to use brackets to show that the monomial is multiplied by all terms in the binomial or trinomial. For example, $2(x + 3)$ means the 2 must be multiplied by each term in the bracket. However, the example could also be written as: $(x - 3)2$. In both cases the 2 is multiplied by the binomial. We illustrate the distributive law with three examples.

Example 1	**Example 2**	**Example 3**
$2(x+3)$ $= 2(x) + 2(3)$ $= 2x + 6$	$(2m-5)4m$ $= 4m(2m) + 4m(-5)$ or $4m(2m) - 4m(5)$ $= 8m^2 - 20m$	$-3(2a + 3b - 4c)$ $= (-3)(2a) + (-3)(3b) + (-3)(-4c)$ or $(-3)(2a) + (-3)(3b) - (-3)(4c)$ $= -6a - 9b + 12c$

e) Working with brackets

Brackets can have several different uses in algebra. For example:

i. We use brackets when we substitute numbers into expressions
ii. We use brackets to separate signs and operations
iii. We can use brackets instead of the multiplication sign (×) as we did with the distributive law
iv. We use brackets to group terms
v. Sometimes we need to use brackets to make our meaning clear

Brackets for substitution	Brackets to separate signs and operations	Brackets to show multiplication
Calculate the value of i) $a - b$ ii) $2a + b$ if $a = 3$ and $b = 4$. i) $a - b$ $= (3) - (4) = -1$ ii) $2a + b$ $= 2(3) + (4)$ $= 6 + 4 = 10$	4 subtract positive 3: $4 - (+3)$ 4 subtract negative 3: $4 - (-3)$ $4x$ subtract positive 3: $4x - (+3)$ $4x$ subtract negative $3x$: $4x - (-3x)$	$2(5)$ is the same as 2×5 which is the same as $5 + 5$. In the same way: $2(3x + y)$ is the same as $2 \times (3x + y)$ which is the same as $(3x + y) + (3x + y)$ Using the distributive law: $2(3x + y)$ $= 2(3x) + 2(y)$ $= 6x + 2y$

Brackets to group terms	Using brackets to make the meaning clear
Compare the following examples: 1) $7 - 5 + 1 = 3$ 2) $(7 - 5) + 1 = 2 + 1 = 3$ 3) $7 - (5 + 1) = 7 - 6 = 1$ In example 2, the brackets do not affect the answer. However, in example 3 the grouping with brackets means that 5 and 1 are added first and then their sum is subtracted from 7. We can also use brackets to emphasise the structure of an expression: 1) $(a + b) + (a + b)$ 2) $a + b + a + b$ The brackets make it easy to see that we are adding the same binomial, i.e. $a + b$	When we write -3^2 does it mean $(-1) \times 3 \times 3$ or $(-3) \times (-3)$? Based on mathematical conventions, we take -3^2 to mean $(-1) \times 3 \times 3 = -9$ If we want to represent "negative 3 squared", we must use brackets: $(-3)^2 = 9$ A similar problem arises with the distributive law: These two expressions are the same $2(x + 5)$ and $(x + 5)2$ because multiplication is commutative. In both expressions, the 2 must be multiplied by both terms in the bracket. BUT if we have negatives, then we need to be careful: Say we have the expressions: $-2(x + 5)$ and $(x + 5) - 2$ These two expressions are different. $-2(x + 5)$ means that both terms in the bracket are multiplied by -2 BUT $(x + 5) - 2$ does not represent multiplication. It represents: "x add 5 subtract 2" and $x + 5 - 2 = x + 3$ When we put the -2 on the right of the bracket, the meaning of the minus symbol changes from "negative" to "subtract". If we want to multiply, then we must put the -2 in brackets: $(x + 5)(-2)$ $= -2x - 10$

7) What makes algebraic notation and terminology confusing?

Here we discuss four cases that illustrate ways in which algebraic notation and terminology can be confusing.

a) Sometimes a symbol represents a sign, sometimes it represents an operation

We have already noted that the minus symbol can represent a sign or an operation. Here we focus on the possible confusions with sign and operation in algebraic notation.

Consider the expression: $4 - 3x$
We say "4 subtract $3x$". This sounds as if the minus symbol does not belong to $3x$. We say the expression has two terms that are separated by the operation of subtraction. This also suggests that the minus symbol does not belong to the $3x$. But then we say the terms are 4 and $-3x$ (four and negative three x) which means the minus symbol *is* connected to the $3x$. We also say "the coefficient of x is negative 3". Once again, this indicates that the minus symbol belongs to the 3.

This is confusing because sometimes we are separating the minus symbol from the 3 and sometimes we are attaching it to the 3. Part of learning algebra involves learning when to combine the minus (or plus) symbol with the letter or number and when to separate it from the letter or number.

Note that if the expression were $4-x$, everything we have said above would still apply. The coefficient of x is -1, and the terms are 4 and – x.

b) Different meanings and uses for the word "term"

The way we use the word *term* can be confusing. We discuss two different situations below.

i) Counting the number of terms in an expression

Consider the terms $3x$ and $5y$. We can represent their sum as $3x+5y$ which is an expression with two terms. The same applies for subtraction: the expression $3x-5y$ has two terms. In both cases the terms are separated by addition or subtraction. However, if we multiply the terms, we write $(3x)(5y)$. Then this is only <u>one</u> term because the $3x$ and $5y$ are not separated by addition or subtraction. The same applies for division: $\frac{3x}{5y}$ is treated as one term.

Now take $3x+5y$ and multiply the expression by 4. We write this as $4(3x+5y)$. This new expression consists of only <u>one</u> term. Why does this happen? Firstly, $(3x+5y)$ is considered as one term when $3x$ and $5y$ are put in brackets, and 4 is a single term. So then we have two single terms that are multiplied. This is treated as one term because there is no addition or subtraction separating 4 and $(3x+5y)$.

But, when we apply the distributive law, we get $4(3x+5y)=12x+20y$

Now we have two terms again because $12x$ and $20y$ are separated by the operation of addition.

ii) Referring to terms in brackets

We have just noted that $4(3x+5y)$ is one term.

When we look inside the bracket, we refer to $3x$ as the *first term in the bracket* and $5y$ as the *second term in the bracket.* But, if you are asked how many terms in $4(3x+5y)$, the correct answer is **one**!!! This may seem weird but it's how we talk about terms in algebra.

c) Seeing the equal sign in two different ways

When you first learned about the equal sign, you treated it as "gives me", e.g. $4+5=\square$. Here we say "4 add 5 *gives me* 9". But when you have a statement like: $4+5=3+\square$, you need to reason as follows: "4 add 5 *is the same as* 3 add something". The left side adds to 9 so the right side must also add to 9. This means the place holder must have a value of 6. So we have $4+5=3+6$ and we say "4 add 5 is the same as 3 add 6".

Here is another example: $4+5=\square-2$.

Once again, we have to see the equal sign as "is the same as". So we need to say "4 add 5 is the same as something subtract 2". If the left side adds to 9, then the right side must also add to 9. This means the place holder must have a value of 11. We can also write this as an equation in x: $4+5=x-2$

d) Thinking that an answer must consist of one term only

When we operate on numbers, we always expect to get one number as the answer. For example: $15-2(1+3)=15-2(4)=15-8=7$. Although we may show several steps, the final answer is 7. We know we are finished because there are no more operations to perform.

Algebra can be confusing because we seldom get a single term for an answer. For example, if we simplify the expression $5+3x+2-x$, we get $3x-x+5+2=2x+7$.

The answer $2x+7$ may seem unfinished because there is an addition operation in the answer. It is tempting to write $2x+7=9x$ but **this is not correct because we cannot add unlike terms**. So the final answer remains as $2x+7$.

When we simplify *numeric* expressions, we are finished a calculation when we have performed all the operations. When we simplify *algebraic* expressions, we are finished when we have performed the operations *on the like terms*.

Worksheet 1.1

In this worksheet you will focus on: the difference between like and unlike terms, adding and subtracting 2 like terms, and using substitution to check answers.

Questions

1) Write in simplest form: (e.g. $3 \times a = a + a + a = 3a$ and $a \times a = a^2$)

   a) $2 \times x =$ b) $x \times x =$ c) $2 \times x \times x =$

2) Look at each pair of terms. Say whether they are like terms or unlike terms. Give reasons for each answer.

   a) $2x$ and x^2 b) $2x^2$ and $3x^2$ c) 2 and $2x$ d) $2x^2$ and $2y^2$

3) Write down the *unlike* term in each list of terms.

   a) $7xr;\ 7x;\ 7rx$ b) $6y;\ 10;\ 10y$ c) $3x;\ 2x^3;\ -3x$

4) Identify the *like* terms in each list. Then add the like terms in each list.

   a) $4x^2;\ 3;\ 3x^2$ b) $7xr;\ 7x;\ 8xr$ c) $6;\ 6y;\ 10$

5) Say whether each statement is TRUE or FALSE. If the statement is false, change the *right* side of the equal sign to make it true.

   a) $6a + 2a = 8a$
   b) $5k^2 + 2k^2 = 7$
   c) $6pr - pr = 5pr$
   d) $6a - 2 = 4a$
   e) $5ab + 6a = 11aba$
   f) $7ab + 2ba = 8a3b$

6) We are going to use substitution to check 2 statements in Q5:

   a) Focus on Q5a: $6a + 2a = 8a$
      i) What is the value of $6a + 2a$ if $a = 3$?
      ii) What is the value of $8a$ if $a = 3$?

      iii) What is the value of $6a + 2a$ if $a = 5$?
      iv) What is the value of $8a$ if $a = 5$?

      v) Repeat the checks for the following values of a: $a = 1, a = -2$ and $a = 0$.

      vi) Can you think of any value of a where $6a + 2a$ will NOT be equal to $8a$? Explain.

   b) Focus on Q5d: $6a - 2 = 4a$
      i) What is the value of $6a - 2$ if $a = 1$?
      ii) What is the value of $4a$ if $a = 1$?

      iii) What is the value of $6a - 2$ if $a = 5$?
      iv) What is the value of $4a$ if $a = 5$?

      v) Repeat the checks if $a = 3, a = -1$ and $a = 0$.

      vi) You should have found one value for a where $6a - 2$ is equal to $4a$. Can you find any other values that will make $6a - 2$ equal to $4a$? Explain your answer using the ideas of like and unlike terms.

Worksheet 1.1

Answers

Questions	**Answers**
1) Write in simplest form: (e.g. $3 \times a = a + a + a = 3a$ and $a \times a = a^2$) a) $2 \times x =$ b) $x \times x =$ c) $2 \times x \times x =$	1) a) $2x$ b) x^2 c) $2x^2$
2) Look at each pair of terms. Say whether they are like terms or unlike terms. Give reasons for each answer. a) $2x$ and x^2 b) $2x^2$ and $3x^2$ c) 2 and $2x$ d) $2x^2$ and $2y^2$	2) a) $2x$ and x^2 are unlike terms. The variable of the 1st term is of degree one. The variable of the 2nd term is of degree two. b) $2x^2$ and $3x^2$ are like terms. The variables of both terms are of degree two. c) 2 and $2x$ are unlike terms. The 1st term is a constant. The 2nd term has a variable of degree one. d) $2x^2$ and $2y^2$ are unlike terms. The 1st term has the variable x and the 2nd term has the variable y.
3) Write down the *unlike* term in each list of terms. a) $7xr;\ 7x;\ 7rx$ b) $6y;\ 10;\ 10y$ c) $3x;\ 2x^3;\ -3x$	3) a) $7x$ b) 10 c) $2x^3$
4) Identify the *like* terms in each list. Then add the like terms in each list. a) $4x^2;\ 3;\ 3x^2$ b) $7xr;\ 7x;\ 8xr$ c) $6;\ 6y;\ 10$	4) a) $4x^2 + 3x^2 = 7x^2$ b) $7xr + 8xr = 15xr$ c) $6 + 10 = 16$
5) Say whether each statement is TRUE or FALSE. If the statement is false, change the *right* side of the equal sign to make it true. a) $6a + 2a = 8a$ b) $5k^2 + 2k^2 = 7$ c) $6pr - pr = 5pr$ d) $6a - 2 = 4a$ e) $5ab + 6a = 11aba$ f) $7ab + 2ba = 8a3b$	5) a) $6a + 2a = 8a$ TRUE b) $5k^2 + 2k^2 = 7$ FALSE $5k^2 + 2k^2 = 7k^2$ c) $6pr - pr = 5pr$ TRUE d) $6a - 2 = 4a$ FALSE $6a - 2 = 6a - 2$ e) $5ab + 6a = 11aba$ FALSE $5ab + 6a = 5ab + 6a$ f) $7ab + 2ba = 8a3b$ FALSE $7ab + 2ba = 9ab$
6) **Answer to a)** a) Focus on Q5a: $6a + 2a = 8a$ i) $6(3) + 2(3) = 24$ ii) $8(3) = 24$ ∴ Equal for $a = 3$ since expressions in Q6a(i) and Q6a(ii) both equal 24. iii) $6(5) + 2(5) = 40$ iv) $8(5) = 40$ ∴ Equal for $a = 3$ v) (1) For $a = 1$, $6a + 2a = 8$ and $8a = 8$ (2) For $a = -2$, $6a + 2a = -16$ and $8a = -16$ (3) For $a = 0$, $6a + 2a = 0$ and $8a = 0$ vi) No. The statement is always true, no matter what value of a you choose. $6a$ and $2a$ are like terms, their sum is $8a$	6) **Answer to b)** b) Focus on Q5d: $6a - 2 = 4a$ i) $6(1) - 2 = 4$ ii) $4(1) = 4$ ∴ Equal for $a = 1$ iii) $6(5) - 2 = 28$ iv) $4(5) = 20$ ∴ Not equal for $a = 5$ since Q6b(iii) and Q6b(iv) have different answers v) (1) For $a = 3$, $6a - 2 = 16$ and $4a = 12$ (2) For $a = -1$, $6a - 2 = -8$ and $4a = -4$ (3) For $a = 0$, $6a - 2 = -2$ and $4a = 0$ vi) No. The only value that gives the same answers is $a = 1$. $6a$ and -2 are unlike terms, they cannot be added.

Worksheet 1.2

In this worksheet you will focus on: the difference between like and unlike terms, adding and subtracting 2 like terms, and using substitution to check answers.

Questions

1) Write in simplest form:
   a) $2 \times y =$
   b) $y \times y =$
   c) $4 \times y \times y =$

2) Look at each pair of terms. Say whether they are like terms or unlike terms. Give reasons for each answer.
   a) $2y$ and y^2
   b) $3x^2$ and x^2
   c) 3 and $3x$
   d) $2m^2$ and $2n^2$

3) Write down the *unlike* term in each list.
   a) $5x;\ 5xy;\ 7yx$
   b) $6y;\ 6;\ 10y$
   c) $3y;\ 2y^3;\ -3y$

4) Identify the *like* terms in each list. Then add the like terms in each list.
   a) $4y^2;\ 3;\ 3y^2$
   b) $7mn;\ 7m;\ 8mn$
   c) $5;\ 5y;\ 10y$

5) Say whether each statement is TRUE or FALSE.
   If the statement is false, change the *right* side of the equal sign to make the statement true.
   a) $8a + 2a = 10a$
   b) $5k^2 + 5k^2 = 10$
   c) $6pr - 2pr = 4pr$
   d) $9a - 2 = 7a$
   e) $7ab + 6a = 13aba$
   f) $11ab + 2ba = 11a2b$

6) We are going to use substitution to check 2 statements in Q6:

   a) Focus on Q6a: $8a + 2a = 10a$
      i) What is the value of $8a + 2a$ if $a = 1$?
      ii) What is the value of $10a$ if $a = 1$?

      iii) What is the value of $8a + 2a$ if $a = 3$?
      iv) What is the value of $10a$ if $a = 3$?

      v) Repeat the checks if $a = -3$, $a = -1$ and $a = 0$.

      vi) Can you think of any value of a where $8a + 2a$ will NOT be equal to $10a$? Explain your answer using the ideas of like and unlike terms.

   b) Focus on Q6d: $9a - 2 = 7a$
      i) What is the value of $9a - 2$ if $a = 1$?
      ii) What is the value of $7a$ if $a = 1$?

      iii) What is the value of $9a - 2$ if $a = 3$?
      iv) What is the value of $7a$ if $a = 3$?

      v) Repeat the checks if $a = -3$, $a = -1$ and $a = 0$.

      vii) You should have found only one value for a where $9a - 2$ is equal to $7a$. Can you find any other values that will make $9a - 2$ equal to $7a$? Explain your answer using the ideas of like and unlike terms.

Worksheet 1.2

Answers

Questions	Answers
1) Write in simplest form: a) $2 \times y =$ b) $y \times y =$ c) $4 \times y \times y =$	1) a) $2y$ b) y^2 c) $4y^2$
2) Look at each pair of terms. Say whether they are like terms or unlike terms. Give reasons for each answer. a) $2y$ and y^2 b) $3x^2$ and x^2 c) 3 and $3x$ d) $2m^2$ and $2n^2$	2) a) $2y$ and y^2 are unlike terms. The variable of the 1st term is of degree one. The variable of the 2nd term is of degree two. b) $3x^2$ and x^2 are like terms. The variables of both terms are of degree two. c) 3 and $3x$ are unlike terms. The 1st term is a constant. The 2nd term has a variable of degree one. d) $2m^2$ and $2n^2$ are unlike terms. The variables of the terms are different.
3) Write down the *unlike* term in each list of terms. a) $5x;\ 5xy;\ 7yx$ b) $6y;\ 6;\ 10y$ c) $3y;\ 2y^3;\ -3y$	3) a) $5x$ b) 6 c) $2y^3$
4) Identify the *like* terms in each list. Then add the like terms in each list a) $4y^2;\ 3;\ 3y$ b) $7mn;\ 7m;\ 8mn$ c) $5;\ 5y;\ 10y$	4) a) $4y^2 + 3y^2$ $= 7y^2$ b) $7mn + 8mn$ $= 15mn$ c) $5 +\ 10$ $= 15$
5) Say whether each statement is TRUE or FALSE. If the statement is false, change the *right* side of the equal sign to make it true. a) $8a + 2a = 10a$ b) $5k^2 + 5k^2 = 10$ c) $6pr - 2pr = 4pr$ d) $9a - 2 = 7a$ e) $7ab + 6a = 13aba$ f) $11ab + 2ba = \ 11a2b$	5) a) $8a + 2a = 10a$ TRUE b) $5k^2 + 5k^2 = 10$ FALSE $5k^2 + 5k^2 = 10k^2$ c) $6pr - 2pr = 4pr$ TRUE d) $9a - 2 = 7a$ FALSE $9a - 2 = 9a - 2$ e) $7ab + 6a = 13aba$ FALSE $7ab + 6a = 7ab + 6a$ f) $11ab + 2ba = 11a2b$ FALSE $11ab + 2ba = \ 11ab$
6) Answer to a) a) Focus on Q6a: $8a + 2a = 10a$ i) $8(1) + 2(1) = 10$ ii) $10(1) = 10 \therefore$ Equal for $a = 1$ iii) $8(3) + 2(3) = 30$ iv) $10(3) = 30 \therefore$ Equal for $a = 3$ v) (1) For $a = -3, 8a + 2a = -30$ and $10a = -30$ (2) For $a = -1, 8a + 2a = -10$ and $10a = -10$ (3) For $a = 0, 8a + 2a = 0$ and $10a = 0$ vi) No. The statement is always true – you can test any value of a. $8a$ and $2a$ are like terms, their sum is $10a$	**6) Answer to b)** b) Focus on Q6d: $9a - 2 = 7a$ i) $9(1) - 2 = 7$ ii) $7(1) = 7 \therefore$ Equal for $a = 1$ iii) $9(3) - 2 = 25$ iv) $7(3) = 21 \therefore$ Not equal for $a = 3$ v) (1) For $a = -3, 9a - 2 = -29$ and $7a = -21$ (2) For $a = -1, 9a - 2 = -11$ and $7a = -7$ (3) For $a = 0, 9a - 2 = -2$ and $7a = 0$ vi) No. The only value that gives the same answers is $a = 1$. $9a$ and -2 are unlike terms, they cannot be added. $7a$ is the result of adding 9 and-2 (or subtracting 2 from 9).

Worksheet 1.3

In this worksheet you will focus on: working with verbal and algebraic expressions, the difference between like and unlike terms, adding and subtracting 2 like terms, and using substitution to check answers.

Questions

1) In the table below the letter g represents any number.
e.g. The verbal expression "a *number increased by 2*" is written as $g + 2$ but it could also be written as $2 + g$. Match the columns. There may be more than one correct answer for some options!

Verbal expression	
1.	8 add a number
2.	A number multiplied by 8
3.	8 subtract a number
4.	A number divided by 8
5.	A number decreased by 8

Algebraic expression	
A	$8 + g$
B	$8g$
C	$g + 8$
D	$g - 8$
E	$g(8)$
F	$8 \div g$
G	$8 - g$
H	$g \div 8$

A *verbal expression* is written in words.
e.g. Add 3 to a number.
An *algebraic expression* uses symbols for operations $(+; -; \times; \div)$ and variables to replace "a number".
e.g. $x + 3$
So here we have replaced the words "a number" with x and we have used the symbol + in place of "add".

2)

a) For each row, shade the like terms in the same colour.

A.	$3x$	$4x^2$	3	$3x^2$	
B.	$7q^2$	$7q^2r$	$8qr$	8	$-8rq$
C.	$2(3b)$	$3b^2$	$9b$		
D.	$5a^2$	$5a$	$2a^3$	$3a^2$	$9a$

b) Add the like terms you shaded in Q2a for A, B and C. Solve for each row separately.

3) Say whether each statement is TRUE or FALSE. If the statement is false, change the part on the *right* of the equal sign to make the statement true.

a) $5a + 7a = 12a^2$

b) $2m - m = 2m$

c) $7 - 3b = 4b$

d) $5a + 6b = 11ab$

Worksheet 1.3 continued

Questions

4) In this question we substitute values to check if expressions are equal.
    a) We will focus on the expressions from Q3c: $7-3b$ and $4b$
        i) What is the value of $7-3b$ if $b=2$?
        ii) What is the value of $4b$ if $b=2$?

        iii) What is the value of $7-3b$ if $b=-2$?
        iv) What is the value of $4b$ if $b=-2$?

        v) Check if $7-3b=4b$ is true when $b=1$ and then if $b=0$.
        vi) Can we say that $7-3b=4b$? Justify your answer.

    b) In Q3d we must compare the expressions $5a+6b$ and $11ab$ to see if they are always equal.
        i) Show that they are not equal if $a=3$ and $b=-2$.
        ii) Show that they are not equal if $a=10$ and $b=10$.
        iii) Are the expressions equal if $a=1$ and $b=1$?
        iv) Choose another set of your own values for a and b and check if the expressions are equal.
        v) Can we conclude that the statement $5a+6b=11ab$ is true? Why/why not?

5) Fill in the missing spaces to make the algebraic statements true:
    a) $2x+4x=$ __
    b) $2x-4x=$ __
    c) $2+3x+4=$ __ $+6$
    d) $2+3x-4x=-x+$ __
    e) $-3x+4+$ ___ $=2x+$ ___
    f) ___ $+$ ___ $-4=5x-4$

6) Collect like terms and simplify:

For the answer:
Write the variable term first,
then write the constant term.

e.g. $2p+4-p$
$=2p-p+4$
$=p+4$

    a) $2+3x+4x+5$
    b) $2+3x-4x+5$
    c) $2-3x+4-5x$
    d) $2-3x-4+5x$

Worksheet 1.3

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>
1) In the table below the letter g represents any number. e.g. The verbal expression "a <i>number increased by 2</i>" is written as $g + 2$ but it could also be written as $2 + g$. Match the columns. There may be more than one correct answer for some options!
<table>
<tr><th colspan="2">Verbal expression</th></tr>
<tr><td>1.</td><td>8 add a number</td></tr>
<tr><td>2.</td><td>A number multiplied by 8</td></tr>
<tr><td>3.</td><td>8 subtract a number</td></tr>
<tr><td>4.</td><td>A number divided by 8</td></tr>
<tr><td>5.</td><td>A number decreased by 8</td></tr>
</table>
<table>
<tr><th colspan="2">Algebraic expression</th></tr>
<tr><td>A</td><td>$8 + g$</td></tr>
<tr><td>B</td><td>$8g$</td></tr>
<tr><td>C</td><td>$g + 8$</td></tr>
<tr><td>D</td><td>$g - 8$</td></tr>
<tr><td>E</td><td>$g(8)$</td></tr>
<tr><td>F</td><td>$8 \div g$</td></tr>
<tr><td>G</td><td>$8 - g$</td></tr>
<tr><td>H</td><td>$g \div 8$</td></tr>
</table>
</td><td>
1)
1. A; C
2. B; E
3. G
4. H
5. D
</td></tr>
<tr><td>
2)
a) For each row, shade the like terms in the same colour.
<table>
<tr><td>A.</td><td>$3x$</td><td>$4x^2$</td><td>3</td><td>$3x^2$</td><td></td></tr>
<tr><td>B.</td><td>$7q^2$</td><td>$7q^2r$</td><td>$8qr$</td><td>8</td><td>$-8rq$</td></tr>
<tr><td>C.</td><td>$2(3b)$</td><td>$3b^2$</td><td>$9b$</td><td></td><td></td></tr>
<tr><td>D.</td><td>$5a^2$</td><td>$5a$</td><td>$2a^3$</td><td>$3a^2$</td><td>$9a$</td></tr>
</table>
b) Add the like terms you shaded in Q2a for A, B and C. Solve for each row separately.
</td><td>
2)
a)
<table>
<tr><td>A.</td><td>$3x$</td><td>$4x^2$</td><td>3</td><td>$3x^2$</td><td></td></tr>
<tr><td>B.</td><td>$7q^2$</td><td>$7q^2r$</td><td>$8qr$</td><td>8</td><td>$-8rq$</td></tr>
<tr><td>C.</td><td>$2(3b)$</td><td>$3b^2$</td><td>$9b$</td><td></td><td></td></tr>
<tr><td>D.</td><td>$5a^2$</td><td>$5a$</td><td>$2a^3$</td><td>$3a^2$</td><td>$9a$</td></tr>
</table>
b)
A. $4x^2 + 3x^2 = 7x^2$
B. $8qr + (-8rq) = 0$
C. $2(3b) + 9b = 15b$
</td></tr>
<tr><td>
3) Say whether each statement is TRUE or FALSE. If the statement is false, change the part on the <i>right</i> of the equal sign to make the statement true.
a) $5a + 7a = 12a^2$
b) $2m - m = 2m$
c) $7 - 3b = 4b$
d) $5a + 6b = 11ab$
</td><td>
3)
a) False: $5a + 7a = 12a$
b) False: $2m - m = m$
c) False: $7 - 3b = 7 - 3b$
d) False: $5a + 6b = 5a + 6b$
</td></tr>
</table>

Worksheet 1.3
Answers continued

Questions	Answers
4) In this question we substitute values to check if expressions are equal. a) We will focus on the expressions from Q3c: $7-3b$ and $4b$ i) What is the value of $7-3b$ if $b=2$? ii) What is the value of $4b$ if $b=2$? iii) What is the value of $7-3b$ if $b=-2$? iv) What is the value of $4b$ if $b=-2$? v) Check if $7-3b=4b$ is true when $b=1$ and then if $b=0$. vi) Can we say that $7-3b=4b$? Justify your answer. b) In Q3d we must compare the expressions $5a+6b$ and $11ab$ to see if they are always equal. i) Show that they are not equal if $a=3$ and $b=-2$. ii) Show that they are not equal if $a=10$ and $b=10$. iii) Are the expressions equal if $a=1$ and $b=1$? iv) Choose another set of your own values for a and b and check if the expressions are equal. v) Can we conclude that the statement $5a+6b=11ab$ is true? Why/why not?	4) a) i) $7-3(2)=1$ ii) $4(2)=8$ ∴ Not equal for $b=2$ iii) $7-3(-2)=13$ iv) $4(-2)=-8$ ∴ Not equal for $b=-2$ v) (1) For $b=1,\ 7-3(1)=4$ and $4(1)=4$ ∴ True for $b=1$ (2) For $b=0,\ 7-3(0)=7$ and $4(0)=0$ ∴ Not true for $b=0$ vi) It is true for $b=1$. But it is not true for all values of b. b) i) $5(3)+6(-2)=3$ and $11(3)(-2)=-66$ ∴ not equal ii) $5(10)+6(10)=110$ and $11(10)(10)=1100$ ∴ not equal iii) They are equal if $a=1$ and $b=1$ iv) Many possible solutions: e.g.: For $a=0$ and $b=1$ then $5(0)+6(1)=6$ and $11(0)(1)=0$ ∴ not true v) The statement is only true when $a=1$ and $b=1$. So we conclude that the statement is not true (for all values of a and b)
5) Fill in the missing spaces to make the algebraic statements true: a) $2x+4x=$ __ b) $2x-4x=$ __ c) $2+3x+4=$ __ $+6$ d) $2+3x-4x=-x+$ __ e) $-3x+4+$ ___ $=2x+$ ___ f) ___ + ___ $-4=5x-4$	5) a) $2+4x=\boldsymbol{6x}$ b) $2x-4x=\boldsymbol{-2x}$ c) $2+3x+4=\boldsymbol{3x}+6$ d) $2+3x-4x=-x+\boldsymbol{2}$ e) $-3x+4+\boldsymbol{5x}=2x+\boldsymbol{4}$ f) Some possibilities to get $5x$. e.g.: $\boldsymbol{2x}+\boldsymbol{3x}-4=5x-4$ or $\boldsymbol{6x}+(\boldsymbol{-x})-4=5x-4$
6) Collect like terms and simplify: e.g. $2p+4-p$ $=2p-p+4$ $=p+4$ a) $2+3x+4x+5$ b) $2+3x-4x+5$ c) $2-3x+4-5x$ d) $2-3x-4+5x$	6) a) $3x+4x+2+5=7x+7$ b) $3x-4x+2+5=-x+7$ c) $-3x-5x+2+4=-8x+6$ d) $-3x+5x+2-4=2x-2$

Worksheet 1.4

In this worksheet you will focus on: working with verbal and algebraic expressions, the difference between like and unlike terms, adding and subtracting 2 like terms, and using substitution to check answers.

Questions

1) In the table below the letter g represents any number.
e.g.: The verbal expression "a *number increased by 2*" is written as $g+2$ but it could also be written as $2+g$. Match the columns. There may be more than one correct answer for some options!

Verbal expression	
1.	A number increased by 6
2.	A number multiplied by 6
3.	6 subtract a number
4.	A number decreased by 6
5.	A number divided by 6

Algebraic expression	
A	$6+g$
B	$6g$
C	$g+6$
D	$g-6$
E	$g(6)$
F	$6 \div g$
G	$6-g$
H	$g \div 6$

2)

a) For each row, shade the like terms in the same colour.

A.	$7x^2$	$2x$	7	$2x^2$	
B.	$4p^2$	$4p^2r$	$5pr$	5	$-5rp$
C.	$3(5b)$	$3b^2$	$9b$		
D.	$6a^2$	$4a$	$2a^3$	$2a^2$	$7a$

b) Add the like terms you shaded in Q2a for A, B and C. Solve for each row separately.

3) Say whether each statement is TRUE or FALSE. If the statement is false, change the part on the *right* of the equal sign to make the statement true.

a) $2a+5a=7a^2$

b) $2p-p=2p$

c) $10-3b=7b$

d) $8a+2b=10ab$

Worksheet 1.4 continued

Questions

4) In this question we substitute values to check if expressions are equal.
   a) Focus on the expressions from Q3c: $10 - 3b$ and $7b$
      i) What is the value of $10 - 3b$ if $b = 1$?
      ii) What is the value of $7b$ if $b = 1$?

      iii) What is the value of $10 - 3b$ if $b = 4$?
      iv) What is the value of $7b$ if $b = 4$?

      v) Repeat the checks for these 3 values: $b = -2$, $b = -1$ and $b = 0$.
      vi) You should have found one value for b where $10 - 3b$ is equal to $7b$. Can you find any other values of b that will make $10 - 3b$ equal to $7b$? Explain your answer using the idea of like and unlike terms.

   b) In Q3d we must compare the expressions $8a + 4b$ and $12ab$ to see if they are always equal.
      i) Show that they are equal if $a = 1$ and $b = 1$.
      ii) Show that they are <u>not</u> equal if $a = 2$ and $b = 1$.
      iii) Will the statements be equal if $a = -1$ and $b = -1$?
      iv) Find another pair of values where the expressions are not equal.
      v) Choose another pair of values for a and b and check if the expressions are equal.
      vi) In general, is the statement $8a + 4b = 12ab$ always true? Why/why not?

5) Fill in the missing spaces to make the algebraic statements true:
   a) $k + 4k =$ __
   b) $3k - 5k =$ __
   c) $1 + 4k + 4 =$ __ $+ 5$
   d) $3k - 4k + 2 = 2 -$ __
   e) $-3k + 5 +$ ___ $= 4k +$ ___
   f) ___ $+$ ___ $- 4 = 3k - 4$

6) Collect like terms and simplify:

   e.g.: $2p + 4 - p$
   $= 2p - p + 4$
   $= p + 4$

   a) $3 + 2y + 5y + 6$
   b) $3 + 2y - 5y$ $+6$
   c) $3 - 2y + 5 - 6y$
   d) $3 - 2y - 5 + 6y$

Worksheet 1.4

Answers

Questions

1) In the table below the letter g represents any number.
e.g.: The verbal expression "a *number increased by 2*" is written as $g + 2$ but it could also be written as $2 + g$. Match the columns.
There may be more than one correct answer for some options!

Verbal expression	
1.	A number increased by 6
2.	A number multiplied by 6
3.	6 subtract a number
4.	A number decreased by 6
5.	A number divided by 6

Algebraic expression	
A	$6 + g$
B	$6g$
C	$g + 6$
D	$g - 6$
E	$g(6)$
F	$6 \div g$
G	$6 - g$
H	$g \div 6$

Answers

1)
1. A; C
2. B; E
3. G
4. D
5. H

Questions

2)
a) For each row, shade the like terms in the same colour.

A.	$7x^2$	$2x$	7	$2x^2$	
B.	$4p^2$	$4p^2r$	$5pr$	5	$-5rp$
C.	$3(5b)$	$3b^2$	$9b$		
D.	$6a^2$	$4a$	$2a^3$	$2a^2$	$7a$

b) Add the like terms you shaded in Q2a for A, B and C. Solve for each row separately.

Answers

2) a)

A.	🟧 $7x^2$	$2x$	7	🟧 $2x^2$	
B.	$4p^2$	$4p^2r$	🟦 $5pr$	5	🟦 $-5rp$
C.	🟪 $3(5b)$	$3b^2$	🟪 $9b$		
D.	🟩 $6a^2$	🟥 $4a$	$2a^3$	🟩 $2a^2$	🟥 $9a$

b)

A. $7x^2 + 2x^2 = 9x^2$

B. $5pr + (-5pr) = 0$

C. $3(5b) + 9b = 24b$

Questions

3) Say whether each statement is TRUE or FALSE. If the statement is false, change the part on the *right* of the equal sign to make the statement true.

a) $2a + 5a = 7a^2$

b) $2p - p = 2p$

c) $10 - 3b = 7b$

d) $8a + 2b = 10ab$

Answers

3)

a)	False:	$2a + 5a = \mathbf{7a}$
b)	False:	$2p - p = \mathbf{p}$
c)	False:	$10 - 3b = \mathbf{10 - 3b}$
d)	False:	$8a + 2b = \mathbf{8a + 2b}$

Worksheet 1.4
Answers continued

Questions	Answers
4) In this question we substitute values to check if expressions are equal. a) Focus on the expressions from Q3c: $10-3b$ and $7b$ i) What is the value of $10-3b$ if $b=1$? ii) What is the value of $7b$ if $b=1$? iii) What is the value of $10-3b$ if $b=4$? iv) What is the value of $7b$ if $b=4$? v) Repeat the checks for these 3 values $b=-2$, $b=-1$ and $b=0$. vi) You should have found one value for b where $10-3b$ is equal to $7b$. Can you find any other values of b that will make $10-3b$ equal to $7b$? Explain your answer using the idea of like and unlike terms. b) In Q3d we must compare the expressions $8a+4b$ and $12ab$ to see if they are always equal. i) Show that they are equal if $a=1$ and $b=1$. ii) Show that they are not equal if $a=2$ and $b=1$. iii) Will the statements be equal if $a=-1$ and $b=-1$? iv) Find another pair of values where the expressions are not equal. v) Choose another pair of values for a and b and check if the expressions are equal. vi) In general, is the statement $8a+4b=12ab$ always true? Why/why not?	4) a) i) $10-3(1)=7$ ii) $7(1)=7$ ∴ Equal for $b=1$, iii) $10-3(4)=-2$ iv) $7(4)=28$ ∴ Not equal v) (1) $b=-2, 10-3(-2)=16$ and $7(-2)=-14$ ∴ Not equal. (2) $b=-1,10-3(-1)=13$ and $7(-1)=-7$ ∴ Not equal. (3) $b=0,\ 10-3(0)=10$ and $7(0)=0$ ∴ Not equal. vi) No other values of b will make $10-3b$ equal to $7b$. 10 and $-3b$ are unlike terms and cannot be subtracted. b) i) $8(1)+4(1)=12$ and $12(1)(1)=12$ ∴ Equal ii) $8(2)+4(1)=20$ and $12(2)(1)=24$ ∴ not equal iii) $8(-1)+4(-1)=-12$ and $12(-1)(-1)=12$. No they won't be equal. iv) Many possible solutions: e.g. If $a=1$ and $b=0$ then $8(1)+4(0)=8$ and $12(1)(0)=0$ ∴ not equal. v) Many possible solutions: e.g. $a=-2$ and $b=2,\ 8(-2)+4(2)=-8$ and $12(-2)(2)=-48$ ∴ not equal . vi) Not always true. It is only true when $a=1$ and $b=1$. Also $8a+2b$ are unlike terms so cannot be added; $10ab$ is the result of adding coefficients of a and b getting rid of the addition operation.
5) Fill in the missing spaces to make the algebraic statements true: a) $k+4k=$ __ b) $3k-5k=$ __ c) $1+4k+4=$ __ $+5$ d) $3k-4k+2=2-$ __ e) $-3k+5+$ ___ $=4k+$ ___ f) ___ $+$ ___ $-4=3k-4$	5) a) $k+4k=\boldsymbol{5k}$ b) $3k-5k=\boldsymbol{-2k}$ c) $1+4k+4=\boldsymbol{4k}+5$ d) $3k-4k+2=2-\boldsymbol{k}$ e) $-3k+5+\boldsymbol{7k}=4k+\ \boldsymbol{5}$ f) Many possible solutions e.g.: $\boldsymbol{2k}+\boldsymbol{k}-4=3k-4$ or $\boldsymbol{5k}+(\boldsymbol{-2k})-4=3k-4$
6) Collect like terms and simplify: e.g.: $2p+4-p$ $=2p-p+4$ $=p+4$ a) $3+2y+5y+6$ b) $3+2y-5y+6$ c) $3-2y+5-6y$ d) $3-2y-5+6y$	6) a) $2y+5y+3+6=7y+9$ b) $2y-5y+3+6=-3y+9$ c) $-2y-6y+3+5=-8y+8$ d) $-2y+6y+3-5=4y-2$

Worksheet 1.5

In this worksheet you will focus on: working with verbal and algebraic expressions, adding and subtracting 3 or 4 like terms, and using substitution to check answers.

Questions

1) In the table below the letter m represents any number. Match the columns. There may be more than one correct answer for some options!

Verbal expression	
e.g. The product of a number and 5 is then increased by 2	
1.	Add 4 to the product of a number and 5
2.	Subtract 4 from the product of a number and 5
3.	Add a number to the product of that number and 5
4.	Subtract a number from the product of that number and 5
5.	Add a number to the product of that number and negative 5

Algebraic expression	
e.g. $5m + 2$	
A	$5m + m$
B	$-4 + 5m$
C	$5m - 4$
D	$m - 5m$
E	$5m - m$
F	$-5m + m$
G	$5m + 4$

2) Write a verbal expression for each of the following:
   a) $y - 3$ b) $y + 20$ c) $3y + 20$ d) $20 - 3y$ e) $3y - y$

3) Simplify each expression:
   a) $6 + 6y + 10 - 5y$
   b) $9ab + 7b + 4b - 2ab$
   c) $7x^2 + 3 - 3x^2 + 6$
   c) $5d + 3e + 12f + 2d - e - 2f$
   d) $cd + 5cd + c - cd$
   e) $k - m + m - k + km$

For the answers:
Write the variable term or the term with more than one variable first, then write the constant term. Write the variables in alphabetical order

4) In this question we will use substitution to check the simplification of 2 expressions in Q3.
   a) Focus on Q3a: $6 + 6y + 10 - 5y$
      i) Determine the value of the unsimplified expression if $y = 3$
      ii) Determine the value of your answer to Q3a if $y = 3$
      iii) Choose another value for y and check if you get the same answers for the unsimplified question and for your answer to Q3a.

   b) Focus on Q3c: $7x^2 + 3 - 3x^2 + 6$
      i) Nikita says: $7x^2 + 3 - 3x^2 + 6 = 10x^2 + 3$
      Choose 3 values for x to show her that her answer is not correct.
      ii) Nikita says that if $x = 1$ or $x = -1$ then her answer is correct.
         (1) Check by substituting $x = 1$ and for $x = -1$.
         (2) Does this mean that $10x^2 + 3$ is the correct answer? Explain.

5) Say whether each statement is TRUE or FALSE. If the statement is false, change the expression on the *left* of the equal to sign to make the statement true. You can substitute values to check.
   a) $6a + 2b + 3a = 11ab$
   b) $5k^2 - 2k^2 + k^2 = 4k^2$
   c) $6pr - 5 + pr = 6pr + 5$
   d) $4c - 4c + 8c = 8c$

Worksheet 1.5

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>

1) In the table below the letter m represents any number. Match the columns. There may be more than one correct answer for some options!

<table>
<tr><th colspan="2">Verbal expression</th></tr>
<tr><td colspan="2">e.g. The product of a number and 5 is then increased by 2</td></tr>
<tr><td>1.</td><td>Add 4 to the product of a number and 5</td></tr>
<tr><td>2.</td><td>Subtract 4 from the product of a number and 5</td></tr>
<tr><td>3.</td><td>Add a number to the product of that number and 5</td></tr>
<tr><td>4.</td><td>Subtract a number from the product of that number and 5</td></tr>
<tr><td>5.</td><td>Add a number to the product of that number and negative 5</td></tr>
</table>

<table>
<tr><th colspan="2">Algebraic expression</th></tr>
<tr><td colspan="2">e.g. $5m + 2$</td></tr>
<tr><td>A</td><td>$5m + m$</td></tr>
<tr><td>B</td><td>$-4 + 5m$</td></tr>
<tr><td>C</td><td>$5m - 4$</td></tr>
<tr><td>D</td><td>$m - 5m$</td></tr>
<tr><td>E</td><td>$5m - m$</td></tr>
<tr><td>F</td><td>$-5m + m$</td></tr>
<tr><td>G</td><td>$5m + 4$</td></tr>
</table>

</td><td>

1)

1. G
2. B and C
3. A
4. E
5. F

</td></tr>
<tr><td>

2) Write a verbal expression for each of the following:

a) $y - 3$
b) $y + 20$
c) $3y + 20$
d) $20 - 3y$
e) $3y - y$

</td><td>

2) Below are some possible verbal expressions.

a) Subtract 3 from a number
b) Add 20 to a number
c) Add 20 to the product of 3 and a number
d) Subtract the product of 3 and a number from 20
e) Subtract a number from the product of 3 and that same number

</td></tr>
<tr><td>

3) Simplify each expression:

a) $6 + 6y + 10 - 5y$ d) $5d + 3e + 12f + 2d - e - 2f$
b) $9ab + 7b + 4b - 2ab$ e) $cd + 5cd + c - cd$
c) $7x^2 + 3 - 3x^2 + 6$ f) $k - m + m - k + km$

</td><td>

3)

a) $y + 16$ d) $7d + 2e + 10f$
b) $7ab + 11b$ e) $5cd + c$
c) $4x^2 + 9$ f) km

</td></tr>
<tr><td>

4) **Answer to Q4a and Q4b(i)**

a) Focus on Q3a: $6 + 6y + 10 - 5y$
i) $6 + 6(3) + 10 - 5(3) = 19$
ii) $(3) + 16 = 19$
iii) Many possible solutions. The answers to the unsimplified and simplified expressions will always be the same.
e.g. if $y = 2$, then $6 + 6(2) + 10 - 5(2) = 18$ and $(2) + 16 = 18$.

b) Focus on Q3c: $7x^2 + 3 - 3x^2 + 6$
i) Many possibilities to show Nikita is not correct.
e.g. If $x = 0, x = 2, x = -2$ then
$7(0)^2 + 3 - 3(0)^2 + 6 = 9$ and $10(0)^2 + 3 = 3$,
$7(2)^2 + 3 - 3(2)^2 + 6 = 25$ and $10(2)^2 + 3 = 43$,
$7(-2)^2 + 3 - 3(-2)^2 + 6 = 25$ and $10(-2)^2 + 3 = 43$

</td><td>

4) **Answer to Q4b(ii)**

b)
ii)
(1) $7(1)^2 + 3 - 3(1)^2 + 6 = 13$ and $10(1)^2 + 3 = 13$
Correct for if $x = 1$
$7(-1)^2 + 3 - 3(-1)^2 + 6 = 13$ and $10(-1)^2 + 3 = 13$
Correct for if $x = -1$
(2) No. We have used three values to show that Nikita is incorrect. Since there are only two values that make her statement true, it is not true for all values of x. So $10x^2 + 3$ cannot be the correct answer.

</td></tr>
<tr><td>

5) TRUE or FALSE. If false, change the expression on the *left* of the equal sign to make the statement true.

a) $6a + 2b + 3a = 11ab$ c) $6pr - 5 + pr = 6pr + 5$
b) $5k^2 - 2k^2 + k^2 = 4k^2$ d) $4c - 4c + 8c = 8c$

Answers Q5b and Q5c b) True c) True

</td><td>

5) **Answers a) and d)**

a) False. Many possible solutions.
e.g. $6a \times 2b - ab = 11ab$ or
$6ab + 2ab + 3ab = 11ab$
d) False. Many possible solutions.
e.g. $5pr + 5 + pr = 6pr + 5$ or
$7pr + 5 - pr = 6pr + 5$

</td></tr>
</table>

Worksheet 1.6

In this worksheet you will focus on: verbal and algebraic expressions, adding and subtracting 3 or 4 like terms and checking solutions.

Questions

1) In the table below the letter m represents any number. Match the columns. There may be more than one correct answer for some options!

Verbal expression	
e.g. The product of a number and 6 is then increased by 3	
1.	Add 2 to the product of a number and 7
2.	Subtract 2 from the product of a number and 7
3.	Add a number to the product of that number and 7
4.	Subtract a number from the product of that number and 7
5.	Add a number to the product of that number and negative 7

Algebraic expression	
e.g. $6m + 3$	
A	$7m + m$
B	$-2 + 7m$
C	$7m - 2$
D	$m - 7m$
E	$7m - m$
F	$-7m + m$
G	$7m + 2$

2) Write a verbal expression for each of the following:
   a) $p - 4$ b) $p + 15$ c) $5p + 15$ d) $15 - 5y$ e) $5y - y$

3) Simplify each expression:
   a) $4 + 4y + 11 - 3y$
   b) $9pr + 7p + 4r - 2pr$
   c) $8y^2 + 2 - 2y^2 - 5$
   d) $6a + 4b + 11c + 2a - b - 2c$
   e) $7cd + cd + 2c - cd$
   f) $r - s + s - r + sr - sr$

4) In this question use <u>substitution</u> to check the simplification of two of examples from Q3.

   a) For Q3a, Jabu says: "4 add 4 add 11 subtract 3 gives me 16. So the answer is $16y$".
      i) Substitute $y = 3$ to show Jabu that his answer is not correct.
      ii) Jabu then says to you: "Check for $y = 1$, it works!" Is Jabu correct?
      iii) Show how would you convince Jabu that the correct answer is $15 + y$.

   b) The correct answer for Q3f is zero!
      i) Choose any values for s and r, and check that $r - s + s - r + sr - sr = 0$
      ii) Choose another pair of values and check again.
      iii) Thabi and Dumi tried to write the expression by changing the order of some terms. Check if their expressions are correct:
         Thabi: $r - r - s + s + sr - sr$
         Dumi: $sr - sr + r - 2s - r$

5) Say whether each statement is TRUE or FALSE. If the statement is false, change the expression on the *left* of the equal sign to make the statement true. You can substitute values to check.
   a) $7x + 3y - 3x = 7xy$
   b) $6m^2 - m^2 + 4m^2 = 9m^2$
   c) $4ab - 5 + ab = 4ab - 5$
   d) $3p - 3p + 7p = 7p$

Worksheet 1.6

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) In the table below the letter m represents any number. Match the columns. There may be more than one correct answer for some options!
<table>
<tr><th colspan="2">Verbal expression</th></tr>
<tr><td colspan="2">e.g. The product of a number and 6 is then increased by 3</td></tr>
<tr><td>1.</td><td>Add 2 to the product of a number and 7</td></tr>
<tr><td>2.</td><td>Subtract 2 from the product of a number and 7</td></tr>
<tr><td>3.</td><td>Add a number to the product of that number and 7</td></tr>
<tr><td>4.</td><td>Subtract a number from the product of that number and 7</td></tr>
<tr><td>5.</td><td>Add a number to the product of that number and negative 7</td></tr>
</table>
<table>
<tr><th colspan="2">Algebraic expression</th></tr>
<tr><td colspan="2">e.g. $6m + 3$</td></tr>
<tr><td>A</td><td>$7m + m$</td></tr>
<tr><td>B</td><td>$-2 + 7m$</td></tr>
<tr><td>C</td><td>$7m - 2$</td></tr>
<tr><td>D</td><td>$m - 7m$</td></tr>
<tr><td>E</td><td>$7m - m$</td></tr>
<tr><td>F</td><td>$-7m + m$</td></tr>
<tr><td>G</td><td>$7m + 2$</td></tr>
</table></td>
<td>1)
1. G
2. B and C
3. A
4. E
5. F</td></tr>
<tr><td>2) Write a verbal expression for each of the following:
a) $p - 4$
b) $p + 15$
c) $5p + 15$
d) $15 - 5y$
e) $5y - y$</td>
<td>2) Possible verbal expressions
a) Subtract 4 from a number
b) Add 15 to a number
c) Add 15 to the product of 5 and a number
d) Subtract the product of 5 and a number from 15
e) Subtract a number from the product of 5 and that same number</td></tr>
<tr><td>3) Simplify each expression:
a) $4 + 4y + 11 - 3y$
b) $9pr + 7p + 4r - 2pr$
c) $8y^2 + 2 - 2y^2 - 5$
d) $6a + 4b + 11c + 2a - b - 2c$
e) $7cd + cd + 2c - cd$
f) $r - s + s - r + sr - sr$</td>
<td>3)
a) $y + 15$
b) $7pr + 7p + 4r$
c) $6y^2 - 3$
d) $8a + 3b + 9c$
e) $7cd + 2c$
f) 0</td></tr>
<tr><td>4) Solution to Q4a
a) Q3a: $4 + 4y + 11 - 3y$
i) $4 + 4(3) + 11 - 3(3) = 18$ and$16(3) = 48$, $18 \neq 48$ Jabu's answer of $16y$ is incorrect.
ii) $4 + 4(1) + 11 - 3(1) = 16$ and $16(1) = 16$ Yes Jabu is correct when $y = 1$
iii) Convincing Jabu:$4 + 4(3) + 11 - 3(3) = 18$ and my answer $15 + (3) = 18$;
$18 = 18$ Your answer is 48. $18 \neq -48$
If $x = -3$: My answer is
$4 + 4(-3) + 11 - 3(-3) = 12$ and
$15 + (-3) = 12; 12 = 12$
Your answer is $16(-3) = -48; 12 \neq -48$
If $x = 0$: My answer is
$4 + 4(0) + 11 - 3(0) = 15$ and
$15 + (0) = 15; 15 = 15$
Your answer is $16(0) = 0;\ 15 \neq 0$</td>
<td>4) Solution to 4a(iii) continued and solution to Q4b
iii) Continued
When we substituted into $4 + 4y + 11 - 3y$ and $15 + y$ both expressions gave the same answer <i>each</i> time BUT when we substituted into $4 + 4y + 11 - 3y$ and $16y$ both expressions gave the same answer <i>only once</i> that was when $y = 1$
b) Q3f: $r - s + s - r + sr - sr$ answer is zero!
i) Own choice. e.g. $r = 2; s = 1$ gives $(2) - (1) + (1) - (2) + (1)(2) - (1)(2) = 0$
ii) Still get 0 with another set of values
iii) Thabi: e.g. using $r = 2; s = 1$
$(2) - (2) - (1) + (1) + (1)(2) - (1)(2) = 0$ which is correct
Dumi: e.g. using $r = 2; s = 1$
$(1)(2) - (1)(2) + (2) - 2(1) - (2) = -2$ which is incorrect
Dumi added $-s + s$ incorrectly</td></tr>
<tr><td>5) TRUE or FALSE. If the statement is false, change the expression on the <i>left</i> of the equal sign to make the statement true.
a) $7x + 3y - 3x = 7xy$
b) $6m^2 - m^2 + 4m^2 = 9m^2$
c) $4ab - 5 + ab = 4ab - 5$
d) $3p - 3p + 7p = 7p$</td>
<td>5)
a) False $4x + 3y$
b) True
c) False $5ab - 5$
d) True</td></tr>
</table>

Worksheet 1.7

In this worksheet you will focus on: verbal and algebraic expressions which include the minus symbol ($-$); adding and subtracting 3 or more like terms in algebraic expressions.

Questions

1) In the table below the letter y represents any number. Match the columns.
There may be more than one correct answer.

Verbal expression	
e.g. A number is multiplied by negative 3 then 2 is subtracted from the product.	
1.	A number is subtracted from the product of 8 and 5
2.	A number is subtracted from the product of 8 and that same number
3.	The product of 8 and an unknown number is increased by 2
4.	Six less than 7 times a number
5.	Six less than negative 7 times a number
6.	Six more than negative 7 times a number

Algebraic expression	
$-3y-2$	
A	$7y-6$
B	$-7y-6$
C	$-7y+6$
D	$7y+6$
E	$8k-k$
F	$8\times5-n$
G	$2+8x$
H	$8p+2$

2) Write a verbal expression for each of the following:

a) $3d+6$ b) $-3d-6$ c) $\frac{x-4}{2}$

3) The table contains 6 expressions (some of them have only 1 term).

$3x$	$2x^2$	4
$-3x+4$	$-x+1$	$7+x$

Choose expressions from the table to add/subtract so that you get the answers below.

e.g. from $3x$; $-x+1$ and 4, I can get $2x+5$

a) $2x^2+x+11$ b) $-4x+1$ c) $7x+7$

4) Simplify:

Write answers in descending powers of the variable. e.g. $-3p+5p^2+7$ is written $5p^2-3p+7$ because a power of 2 is bigger than a power of 1

a) $7a-7a^2-2a^2$ b) $2a-7a^2+2a^2$ c) $-5ab-7ba+ab+6ba$

d) $5ac+9ca-2ca-ac$ e) $5m-4m+3m-2m+m$ f) $-t^2-2t^2+2y^2-3y^2$

Worksheet 1.7

Answers

Questions

1) In the table below the letter y represents any number. Match the columns. There may be more than one correct answer.

Verbal expression	
e.g. A number is multiplied by negative 3 then 2 is subtracted from the product.	
1.	A number is subtracted from the product of 8 and 5
2.	A number is subtracted from the product of 8 and that same number
3.	The product of 8 and an unknown number is increased by 2
4.	Six less than 7 times a number
5.	Six less than negative 7 times a number
6.	Six more than negative 7 times a number

Algebraic expression	
e.g.	$-3y - 2$
A	$7y - 6$
B	$-7y - 6$
C	$-7y + 6$
D	$7y + 6$
E	$8k - k$
F	$8 \times 5 - n$
G	$2 + 8x$
H	$8p + 2$

Answers

1)

1. F
2. E
3. G and H
4. A
5. B
6. C

Questions

2) Write a verbal expression for each of the following:

a) $3d + 6$

b) $-3d - 6$

c) $\frac{x-4}{2}$

Answers

2) The following are possible verbal expressions

a) 6 is added to the product of a number and 3.

b) 6 is subtracted from the product of a number and negative 3.

c) 4 subtracted from a number is then divided by two.

Questions

3) The table contains 6 expressions (some of them have only 1 term).

$3x$	$2x^2$	4
$-3x + 4$	$-x + 1$	$7 + x$

Choose expressions from the table to add/subtract so that you get the answers below. e.g. from $3x$; $-x + 1$ and 4, I can get $2x + 5$

a) $2x^2 + x + 11$

b) $-4x + 1$

c) $7x + 7$

Answers

3) The expressions can be combined in different orders by they must produce the correct expression.

a) $(2x^2) + (7 + x) + (4)$
$= 2x^2 + x + 11$

b) $(-x + 1) - (3x) = -4x + 1$

c) $(7 + x) - (-3x + 4) + (4) + (3x)$
$= 7x + 7$

Questions

4) Simplify.

a) $7a - 7a^2 - 2a^2$

b) $2a - 7a^2 + 2a^2$

c) $-5ab - 7ba + ab + 6ba$

d) $5ac + 9ca - 2ca - ac$

e) $5m - 4m + 3m - 2m + m$

f) $-t^2 - 2t^2 + 2y^2 - 3y^2$

Answers

4) Answers are in descending powers of the variable where applicable

a) $-9a^2 + 7a+$

b) $-5a^2 + 2a$

c) $-5ab$

d) $11ac$

e) $3m$

f) $-3t^2 - y^2$

Worksheet 1.8

In this worksheet you will focus on: verbal and algebraic expressions which include the minus symbol (−); adding and subtracting 3 or more like terms in algebraic expressions.

Questions

1) In the table below the letter n represents any number. Match the columns.
There may be more than one correct answer.

Verbal expression	
e.g. A number is multiplied by negative 3 then 2 is subtracted from the product.	
1.	A number is subtracted from the product of 3 and 4
2.	A number is subtracted from the product of 5 and that same number
3.	The product of 5 and a number is decreased by 4
4.	Four more than 5 times a number
5.	Four more than negative 5 times a number
6.	Four less than negative 5 times a number

Algebraic expression	
e.g. $-3n-2$	
A	$4+5n$
B	$-7y-6$
C	$4.3-n$
D	$12-n$
E	$4-5n$
F	$n-5n$
G	$-5n-4$
H	$5n-4$

2) Write a verbal expression for each of the following:
   a) $2m+5$
   b) $-2k-4$
   c) $\frac{z+3}{4}$

a) The table contains 6 expressions (some of them have only 1 term)

$2a$	$2a^2$	5
$-3a+5$	$4-a^2$	$a+3$

Choose expressions from the table to add/subtract so that you get the answers below.
e.g. from $2a$; $a+3$, I can get $3a+3$

a) $3a+8$
b) $3a^2+1$
c) $2a^2+13$

4) Simplify.
   a) $5a-10a^2+5a$
   b) $-b^2-2b^2+2b-3b$
   c) $2y-5y^2+2y$
   d) $8m-7+6m-5m+4m$
   e) $-5ab-7ba+ab+6ba$
   f) $6mn-9nm-2mn+nm$

Worksheet 1.8

Answers

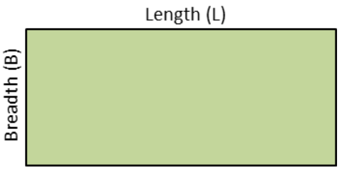
<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) In the table below the letter n represents any number. Match the columns.
There may be more than one correct answer.
<table>
<tr><th colspan="2">Verbal expression</th></tr>
<tr><td colspan="2">e.g. A number is multiplied by negative 3 then 2 is subtracted from the product.</td></tr>
<tr><td>1.</td><td>A number is subtracted from the product of 3 and 4</td></tr>
<tr><td>2.</td><td>A number is subtracted from the product of 5 and that same number</td></tr>
<tr><td>3.</td><td>The product of 5 and a number is decreased by 4</td></tr>
<tr><td>4.</td><td>Four more than 5 times a number</td></tr>
<tr><td>5.</td><td>Four more than negative 5 times a number</td></tr>
<tr><td>6.</td><td>Four less than negative 5 times a number</td></tr>
</table>
<table>
<tr><th colspan="2">Algebraic expression</th></tr>
<tr><td colspan="2">e.g. $-3n-2$</td></tr>
<tr><td>A</td><td>$4+5n$</td></tr>
<tr><td>B</td><td>$-7y-6$</td></tr>
<tr><td>C</td><td>$4.3-n$</td></tr>
<tr><td>D</td><td>$12-n$</td></tr>
<tr><td>E</td><td>$4-5n$</td></tr>
<tr><td>F</td><td>$n-5n$</td></tr>
<tr><td>G</td><td>$-5n-4$</td></tr>
<tr><td>H</td><td>$5n-4$</td></tr>
</table>
</td><td>1)
1. C and D
2. No match
$5n-n$
3. H
4. A
5. E
6. G</td></tr>
<tr><td>2) Write a verbal expression for each of the following:
a) $2m+5$
b) $-2k-4$
c) $\frac{z+3}{4}$</td><td>2) Possible verbal expressions
a) 5 added to the product of 2 and a number.
b) 4 is subtracted from negative 2 and a number.
c) A number is added to 3 and then the sum is divided by 4.</td></tr>
<tr><td>3) The table contains 6 expressions (some of them have only 1 term)
<table>
<tr><td>$2a$</td><td>$2a^2$</td><td>5</td></tr>
<tr><td>$-3a+5$</td><td>$4-a^2$</td><td>$a+3$</td></tr>
</table>
Choose expressions from the table to add/subtract so that you get the answers below.
e.g. from $2a;\ a+3$, I can get $3a+3$
a) $3a+8$
b) $3a^2+1$
c) $2a^2+13$</td><td>3)
a) $(2a)+(a+3)+(5)=3a+8$
b) $(2a^2)-(4-a^2)+(5)=3a^2+1$
c) $(2a^2)+(-3a+5)+(a+3)+(2a)+(5)$
$=2a^2+13$</td></tr>
<tr><td>4) Simplify.
a) $5a-10a^2+5a$
b) $-b^2-2b^2+2b-3b$
c) $2y-5y^2+2y$
d) $8m-7+6m-5m+4m$
e) $-5ab-7ba+ab+6ba$
f) $6mn-9nm-2mn+nm$</td><td>4) Answers are in descending powers of the variable where applicable
a) $-10a^2+10a$ or $10a-10a^2$
b) $-3b^2-b$ or $-b-3b^2$
c) $-5y^2+4y$ or $4y-5y^2+$
d) $13m-7$
e) $-5ab$
f) $-4mn$</td></tr>
</table>

Worksheet 2.1

In this worksheet you will focus on substituting values into familiar formulae, and into different algebraic expressions.

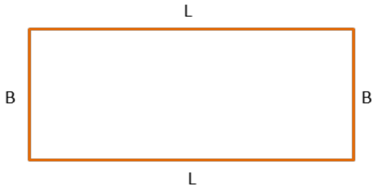
Questions

1) The formula for the area of a rectangle is: **Area = length x breadth**.
The area is shaded and we will abbreviate this as $A = L \times B$



a) If $L = 4$ cm and $B = 3$ cm, calculate the area in cm^2.
b) If $L = 12$ cm and $B = 8$ cm, calculate the area in cm^2.
c) If $L = 3{,}5$ cm and $B = 2$ cm, calculate the area in cm^2.
d) If $L = 7$ cm and $A = 14$ cm^2, calculate the breadth in cm.
e) If $B = 4$ cm and $A = 24$ cm^2, calculate the length in cm.
f) If $L = x$ cm and $B = 5$ cm, give an expression for the area in terms of x.
g) If $L = 2a$ cm and $B = (a + 4)$cm, give an expression for area in terms of a.

2) The formula for the perimeter of a rectangle is: **Perimeter = 2 x length + 2x breadth**
We will abbreviate this as: $\mathrm{P} = 2\mathrm{L} + 2\mathrm{B}$



a) If $L = 4$ cm and $B = 3$ cm, calculate the perimeter in cm.
b) If $L = 12$ cm and $B = 8$ cm, calculate the perimeter in cm.
c) If $L = 3{,}5$ cm and $B = 2$ cm, calculate the area in cm^2.
d) If $L = 7$ cm and $P = 20$ cm^2, calculate the breadth in cm.
e) If $P = 66$ cm and $B = 8$ cm^2, calculate the length in cm.
f) If $L = x$ cm and $B = 5$ cm, give an expression for the perimeter in terms of x.
g) If $L = 4a$ cm and $B = (a + 1)$ cm , give an expression for the perimeter in terms of a.

2)
a) If $a = 5$ and $b = -2$, calculate the value of:
    i) $a + b$
    ii) ab
    iii) $-ab$
    iv) $5ab$

b) Give two pairs of values for m and n so that:
    i) $m + n$ gives an answer of 5
    ii) mn gives an answer of 5

3) Given the expression: $y = x + 3$.
a) Determine the value of y if $x = 8$.
b) What value must we substitute for x so that $y = 8$? Try to do this "in your head".
c) Give 3 values that we can substitute for x so that y will be greater than 8.
d) What value must we substitute for x to make $y = 0$?

4) Consider the following rule: $\boldsymbol{L = 2M + 3}$
Match the $\boldsymbol{M}$-value to the statement about the $\boldsymbol{L}$-value
e.g. If $M = 5$, then $L = 2(5) + 3 = 13$, and we can say L is a prime number

$\boldsymbol{M}$-value
a) 4
b) -5
c) -3
d) -9

Statement about the $\boldsymbol{L}$-value
A. L must be greater than -8 but less than 0
B. L must be less than 0 but greater than -4
C. L must be a negative multiple of 5
D. L must be a prime number

Worksheet 2.1

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) The formula for the area of a rectangle is: **Area = length x breadth**.
The area is shaded and we will abbreviate this as $A = L \times B$
a) If $L = 4$ cm and $B = 3$ cm, calculate the area in cm^2.
b) If $L = 12$ cm and $B = 8$ cm, calculate the area in cm^2.
c) If $L = 3{,}5$ cm and $B = 2$ cm, calculate the area in cm^2.
d) If $L = 7$ cm and $A = 14$ cm^2, calculate the breadth in cm.
e) If $B = 4$ cm and $A = 24$ cm^2, calculate the length in cm.
f) If $L = x$ cm and $B = 5$ cm, give an expression for the area in terms of x.
g) If $L = 2a$ cm and $B = (a + 4)$ cm, give an expression for area in terms of a.</td><td>1)
a) $A = 4 \times 3 = 12$ cm^2
b) $A = 12 \times 8 = 96$ cm^2
c) $A = 3{,}5 \times 2 = 7$ cm^2
d) $14 = 7 \times B \quad \therefore B = 2$ cm
e) $24 = L \times 4 \quad \therefore L = 6$ cm
f) $A = x \times 5 = 5x$ cm^2
g) $A = 2a(a + 4)$
$= 2a^2 + 8a$ cm^2
(learners may not yet be able to produce expanded version)</td></tr>
<tr><td>2) The formula for the perimeter of a rectangle is:
Perimeter = 2 x length + 2 x breadth
We will abbreviate this as: $P = 2L + 2B$
a) If $L = 4$ cm and $B = 3$ cm, calculate the perimeter in cm.
b) If $L = 12$ cm and $B = 8$ cm, calculate the perimeter in cm.
c) If $L = 3{,}5$ cm and $B = 2$ cm, calculate the area in cm^2.
d) If $L = 7$ cm and $P = 20$ cm^2, calculate the breadth in cm.
e) If $P = 66$ cm and $B = 8$ cm^2, calculate the length in cm.
f) If $L = x$ cm and $B = 5$ cm, give an expression for the perimeter in terms of x.
g) If $L = 4a$ cm and $B = (a + 1)$ cm , give an expression for the perimeter in terms of a.</td><td>2)
a) $P = 2(4) + 2(3) = 14$ cm
b) $P = 2(12) + 2(8) = 40$ cm
c) $P = 2(3{,}5) + 2(2) = 11$ cm
d) $20 = 2(7) + 2B \quad \therefore B = 3$ cm
e) $66 = 2L + 2(8) \quad \therefore L = 25$ cm
f) $P = 2(x) + 2(5) = 2x + 10$ cm
g) $P = 2(4a) + 2(a + 1)$
$= 8a + 2a + 2 = 10a + 2$ cm
(may not yet be able to produce expanded version)</td></tr>
<tr><td>3)
e) If $a = 5$ and $b = -2$ determine the value of:
v) $a + b$
vi) ab
vii) $-ab$
viii) $5ab$
f) Give two pairs of values for m and n so that:
iii) $m + n$ gives an answer of 5
iv) mn gives an answer of 5</td><td>3)
a)
i) 3
ii) -10
iii) 10
iv) -50
b) There are many possibilities
i) e.g. $m = 0$ and $n = 5$; $m = -1$ and $n = 6$; $m = 1\frac{1}{2}$ and $n = 3\frac{1}{2}$
ii) e.g. $m = 1$ and $n = 5$; $m = -1$ and $n = -5$; $m = 5$ and $n = 1$; $m = \frac{1}{2}$ and $n = 10$</td></tr>
<tr><td>4) Given the expression: $y = x + 3$.
c) Determine the value of y if $x = 8$.
d) What value must we substitute for x so that $y = 8$? Try to do this “in your head”.
g) Give 3 values that we can substitute for x so that y will be greater than 8.
h) What value must we substitute for x to make $y = 0$?</td><td>4)
a) $y = 11$
b) $x = 5$
c) Any value where $x > 5$
d) $x = -3$</td></tr>
<tr><td>5) Consider the following rule: $\boldsymbol{L = 2M + 3}$
Match the $\boldsymbol{M}$-value to the statement about the $\boldsymbol{L}$-value
e.g. If $M = 5$, then $L = 2(5) + 3 = 13$, and we can say L is a prime number
<table>
<tr><th>$\boldsymbol{M}$-value</th></tr>
<tr><td>e) 4</td></tr>
<tr><td>f) -5</td></tr>
<tr><td>g) -3</td></tr>
<tr><td>h) -9</td></tr>
</table>
<table>
<tr><th>Statement about the $\boldsymbol{L}$-value</th></tr>
<tr><td>A. L must be greater than -8 but less than 0</td></tr>
<tr><td>B. L must be less than 0 but greater than -4</td></tr>
<tr><td>C. L must be a negative multiple of 5</td></tr>
<tr><td>D. L must be a prime number</td></tr>
</table></td><td>5)
<table>
<tr><th>$\boldsymbol{M}$</th><th>$\boldsymbol{L = 2M + 3}$</th><th>$\boldsymbol{L}$</th></tr>
<tr><td>a) 4</td><td>$L = 2(4) + 3 = 11$</td><td>D</td></tr>
<tr><td>b) -5</td><td>$L = 2(-5) + 3 = -7$</td><td>A</td></tr>
<tr><td>c) -3</td><td>$L = 2(-3) + 3 = -3$</td><td>B</td></tr>
<tr><td>d) -9</td><td>$L = 2(-9) + 3 = -15$</td><td>C</td></tr>
</table></td></tr>
</table>

Worksheet 2.2

In this worksheet you will focus on: a variable having a specific value or a variety of values.

Questions

1) The box contains 3 examples of rules for calculating the value of y.

A. $y = x - 2$
B. $y = 2 - x$
C. $y = 2x - 4$

a) For each example, determine by inspection what value of x will make $y = 10$.
e.g. If $y = x + 2$, then $y = 6$ when $x = 4$.
b) For each example, determine the value of y if $x = 10$.
c) Make up your own rule for $y =$ _____ and find an x-value that will make the y-value larger than 20.
e.g. Say I choose $y = 3 + x$. If $x = 19$, then $y = 3 + 19 = 22$ which is bigger than 20

2) Give 3 possible values for a and b to make the statement true:
e.g. If $a + b = 4$, then $a = 3, b = 1$; OR $a = 2, b = 2$; OR $a = 6, b = -2$, OR $a = \frac{1}{2}, b = 3\frac{1}{2}$, etc.

a) $a + b = 10$
b) $a - b = 10$
c) $b - a = 10$

3)

a) If $c = -2$ and $d = 3$, determine the value of cd.
b) If $c = 2$ and $d = -3$, determine the value of cd.
c) You should get the same answer for Q3a and Q3b. Why does this happen?
d) If $c = -2$ and $d = -3$, determine the value of cd.
e) Give two pairs of values for c and d so that the expression $c + d$ gives the same answer as your answer in Q3d.

4) Here are two rules:
1: $C = D + 4$
2: $C = double\ D$

a) If $D = 3$, which of the rules will produce a larger value of C?
b) If $D = -1$, which of the rules with produce a smaller value of C?
c) If $D = 4$, will either of the rules produce a C-value equal to 8?
d) If $D = -3$, will either rule produce a C-value that is bigger than -8 but less than 0?

Worksheet 2.2

Answers

Questions	**Answers**
1) The box contains 3 examples of rules for calculating the value of y. A. $y = x - 2$ B. $y = 2 - x$ C. $y = 2x - 4$ a) For each example, determine by inspection what value of x will make $y = 10$. e.g. If $y = x + 2$, then $y = 6$ when $x = 4$. b) For each example, determine the value of y if $x = 10$. c) Make up your own rule for $y =$ ___ ___and find an x-value that will make the y-value larger than 20. e.g. Say I choose $y = 3 + x$. If $x = 19$, then $y = 3 + 19 = 22$ which is bigger than 20	1) a) A. $x = 12$ B. $x = -8$ C. $x = 7$ b) A. $y = 8$ B. $y = -8$ C. $y = 16$ c) Multiple solutions e.g. $y = \frac{x}{2}$; if $x = 100$ then $y = 50$ which is bigger than 20
2) Give 3 possible values for a and b to make the statement true: e.g. If $a + b = 4$, then $a = 3, b = 1$; OR $a = 2, b = 2$; OR $a = 6, b = -2$, OR $a = \frac{1}{2}, b = 3\frac{1}{2}$, etc. a) $a + b = 10$ b) $a - b = 10$ c) $b - a = 10$	2) Multiple solutions, e.g.: a) $a = 2$ and $b = 8$; $a = \frac{1}{2}$ and $b = 9\ \frac{1}{2}$; $a = -3$ and $b = 13$ b) $a = 15$ and $b = 5$; $a = 11\frac{1}{2}$ and $b = 1\frac{1}{2}$; $a = -3$ and $b = -13$ c) $a = 6$ and $b = 16$; $a = 2\frac{1}{2}$ and $b = 12\frac{1}{2}$; $a = -6$ and $b = 4$
3) a) If $c = -2$ and $d = 3$, determine the value of cd. b) If $c = 2$ and $d = -3$, determine the value of cd. c) You should get the same answer for Q3a and Q3b. Why does this happen? d) If $c = -2$ and $d = -3$, determine the value of cd. e) Give two pairs of values for c and d so that the expression $c + d$ gives the same answer as your answer in Q3d.	3) a) -6 b) -6 c) Because in Q3a we multiply a negative by a positive and in Q3b we multiply a positive by a negative and both result in a negative number. Since the numerals are both 2 and 3 we get -6 in both cases. d) 6 e) Multiple solutions, e.g.: $c = -3$ and $d = 9$; $c = 1$ and $d = 5$; $c = \frac{1}{4}$ and $d = 5\frac{3}{4}$
4) Here are two rules: **1:** $C = D + 4$ **2:** $C = double\ D$ a) If $D = 3$, which of the rules will produce a larger value of C? b) If $D = -1$, which of the rules with produce a smaller value of C? c) If $D = 4$, will either of the rules produce a C-value equal to 8? d) If $D = -3$, will either rule produce a C-value that is bigger than -8 but less than 0?	4) a) $C = (3) + 4 = 7$ $C = double\ D = 2(3) = 6$ Rule 1 b) $C = (-1) + 4 = 5$ $C = double\ D = 2(-1) = -2$ Rule 2 c) $C = (4) + 4 = 8$ $C = double\ D = 2(4) = 8$ Yes, both rules d) $C = (-3) + 4 = 1$ $C = double\ D = 2(-3) = -6$ Yes, Rule 2

Worksheet 2.3

In this worksheet you will focus on: a variable having a specific value or a variety of values.

Questions

1) The box contains 4 examples of rules for calculating the value of y.

A. $y = 2x + 10$
B. $2x - 10 = y$
C. $y = 12 - x$
D. $y = x - 12$

a) For each example, determine what value of x will make $y = 10$.
e.g. If $y = x + 2$, then $y = 6$ when $x = 4$
b) Which example will give a y-value less than 4 when $x = 6$?

2) Give 3 possible values for each letter to make the statement true:
e.g. If $a + b = 4$, then $a = 3, b = 1$; OR $a = 2, b = 2$; OR $a = 6, b = -2$, OR $a = \frac{1}{2}, b = 3\frac{1}{2}$, etc.
a) $b - a = 1$
b) $a - 2b = 0$
c) $a + b$ is even and less than 20

3) Here are two rules:
1: T1 = D + 3
2: T 2= double D

a) Give a value for D that will make T1 =20.
b) Give a value for D that will make T2 =20.
c) Give a value for D that will make T1 > T2.
d) Give a value for D that will make T1 = T2.
e) If $D = -3$, which rule will produce the larger answer?
f) If $D = -\frac{1}{2}$, will either rule produce a value that is bigger than -1 but less than 6?

4)
a) If $m = 6$ and $n = 2$, determine the value of $m - n$.
b) If $m = 6$ and $n = -2$, determine the value of $m + n$.
c) You should get the same answer for Q4a and Q4b. Why does this happen?

d) You are told that $A = mn - n + m$
i) If $m = -2$ and $n = -3$, determine the value of A.
ii) Give two pairs of values for m and n so that the value of A is less than 0.

Worksheet 2.3

Answers

Questions	Answers
1) The box contains 4 examples of rules for calculating the value of y. E. $y = 2x + 10$ F. $2x - 10 = y$ G. $y = 12 - x$ H. $y = x - 12$ a) For each example, determine what value of x will make $y = 10$. e.g. If $y = x + 2$, then $y = 6$ when $x = 4$ b) Which example will give a y-value less than 4 when $x = 6$?	1) a) A. $x = 0$ B. $x = 10$ C. $x = 2$ D. $x = 22$ b) Example D
2) Give 3 possible values for each letter to make the statement true: e.g. If $a + b = 4$, then $a = 3, b = 1$; OR $a = 2, b = 2$; OR $a = 6, b = -2$, OR $a = \frac{1}{2}, b = 3\frac{1}{2}$, etc. a) $b - a = 1$ b) $a - 2b = 0$ c) $a + b$ is even and less than 20	2) Multiple solutions, for example: a) $a = 2$ and $b = 3$; $a = \frac{1}{2}$ and $b = 1\frac{1}{2}$; $a = -3$ and $b = -2$ b) $a = 10$ and $b = 5$; $a = 1$ and $b = \frac{1}{2}$; $a = -6$ and $b = 3$ c) $a = 10$ and $b = 2$; $a = \frac{1}{2}$ and $b = 5\frac{1}{2}$; $a = -3$ and $b = -51$
3) Here are two rules: **1:** T1 = D + 3 **2:** T 2= double D a) Give a value for D that will make T1 =20. b) Give a value for D that will make T2 =20. c) Give a value for D that will make T1 > T2. d) Give a value for D that will make T1 = T2. e) If $D = -3$, which rule will produce the larger answer? f) If $D = -\frac{1}{2}$, will either rule produce a value that is bigger than -1 but less than 6?	3) a) D= 7 b) D= 0 c) Multiple solutions, for example: D= -1 d) D= 3 e) Rule 1 f) Yes, rule 1
4) a) If $m = 6$ and $n = 2$, determine the value of $m - n$. b) If $m = 6$ and $n = -2$, determine the value of $m + n$. c) You should get the same answer for Q4a and Q4b. Why does this happen? d) You are told that $A = mn - n + m$ i) If $m = -2$ and $n = -3$, determine the value of A. ii) Give two pairs of values for m and n so that the value of A is less than 0.	4) a) 4 b) 4 c) Because subtracting a positive is the same as adding a negative d) i) A= 7 ii) Multiple solutions e.g. $m = 5$ and $n = -10$; $m = \frac{1}{2}$ and $n = 10$

Worksheet 3.1

In this worksheet you will focus on: a variable as part of a product, using the distributive law when monomials are positive and binomials have positive terms.

Questions

1)

a) Expand:

i) $3(p) =$ ii) $3(p^2) =$ iii) $3(2p) =$ iv) $3(2 + p) =$

b) In each example what operation is between the 3 and the brackets?

c) Why do you get 2 terms in your answer to Q1a(iv)?

2) Look at examples A to D in the box below:

A. $p\ (p + 2)$
B. $3p\ (p + 2)$
C. $3p\ (p^2 + 2)$
D. $3p^2\ (p + 2)$

a) Write down the monomial for each example.

b) Write down the binomial for each example.

c) Which example will NOT have a term with p^2 after the expression has been expanded? Try to do this by inspection.

d) Expand A to D.

e) Look at your answers to C and D. What is the same and what is different?

3) Look at examples A to D in the box below:

A. $a\ (a^2 + 2)$
B. $a\ (a^2 + 2a)$
C. $a\ (a^2 + 2b)$
D. $a\ (a^2 + 2ab)$

a) What is the same about each example?

b) What is the different about each example?

c) Which examples will have a term with a^2 after the expression has been expanded? Try to do this by inspection.

d) Will any example have a term with ab after the expression has been expanded? Try to do this by inspection.

e) Expand A to D.

4)

a) Expand and write the powers in your answers from smallest to largest

i) $3m(2 + m)$

ii) $5r^2(2 + r)$

b) The following expression has 2 variables, a and b: $ab(a + 3b)$

i) Expand the expression and write your answer so that the powers of a go from smallest to largest.

ii) Now rewrite your answers so that the powers of b go from largest to smallest.

Worksheet 3.1

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1)
a) Expand:
i) $3(p) =$
ii) $3(p^2) =$
iii) $3(2p) =$
iv) $3(2+p) =$
b) In each example what operation is between the 3 and the brackets?
c) Why do you get 2 terms in your answer to Q1a(iv)?</td><td>1)
a)
i) $3p$
ii) $3p^2$
iii) $6p$
iv) $6+3p$
b) Multiplication
c) Because 2 and p are unlike terms</td></tr>
<tr><td>2) Look at examples A to D in the box below:
A. $p\,(p+2)$
B. $3p\,(p+2)$
C. $3p\,(p^2+2)$
D. $3p^2\,(p+2)$
a) Write down the monomial for each example.
b) Write down the binomial for each example.
c) Which example will NOT have a term with p^2 after the expression has been expanded? Try to do this by inspection.
d) Expand A to D.
e) Look at your answers to C and D. What is the same and what is different?</td><td>2)<table><tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>a)</td><td>p</td><td>$3p$</td><td>$3p$</td><td>$3p^2$</td></tr><tr><td>b)</td><td>$p+2$</td><td>$p+2$</td><td>p^2+2</td><td>$p+2$</td></tr></table>c) C
d)
A. p^2+2p
B. $3p^2+6p$
C. $3p^3+6p$
D. $3p^3+6p^2$
e) Same: First term is $3p^3$
Different: Second terms are $6p$ and $6p^2$</td></tr>
<tr><td>3) Look at examples A to D in the box below:
A. $a\,(a^2+2)$
B. $a\,(a^2+2a)$
C. $a\,(a^2+2b)$
D. $a\,(a^2+2ab)$
a) What is the same about each example?
b) What is the different about each example?
c) Which examples will have a term with a^2 after the expression has been expanded? Try to do this by inspection.
d) Will any example have a term with ab after the expression has been expanded? Try to do this by inspection.
e) Expand A to D.</td><td>3)
a) Monomial is always a; the first term in the bracket is always a^2; all brackets involve addition and there is a 2 in the second term in each bracket.
b) The second term in the bracket – constant, 1 letter, 2 letters
c) B, C
d) Yes, C
e)
A. a^3+2a
B. a^3+2a^2
C. a^3+2ab
D. a^3+2a^2b</td></tr>
<tr><td>4)
a) Expand and write the powers in your answers from smallest to largest
i) $3m(2+m)$
ii) $5r^2(2+r)$
b) The following expression has 2 variables, a and b: $ab(a+3b)$
i) Expand the expression and write your answer so that the powers of a go from smallest to largest.
ii) Now rewrite your answers so that the powers of b go from largest to smallest.</td><td>4)
a)
i) $6m+3m^2$
ii) $10r^2+5r^3$
b)
i) $3ab^2+a^2b$
ii) a^2b+3ab^2</td></tr>
</table>

Worksheet 3.2

In this worksheet you will focus on: a variable as part of a product, using the distributive law when monomials are positive and binomials have positive terms.

Questions

1)

a) Expand:

i) $7(p) =$ ii) $7(p^2) =$ iii) $7(3p) =$ iv) $7(3 + p) =$

b) In each example what operation is between the 7 and the brackets?

c) Why do you get two terms in your answer to Q1a(iv)?

2) Look at examples A to D in the box below:

A. $x\,(x + 3)$
B. $4x\,(x + 3)$
C. $4x\,(x^2 + 3)$
D. $4x^2\,(x + 3)$

a) Write down the monomial for each example.
b) Write down the binomial for each example.
c) Which example will NOT have a term with x^2 after the expression has been expanded?
d) Expand A to D.
e) Look at your answers to C and D. What is the same and what is different?

3) Look at examples A to D in the box below:

A. $a\,(a^2 + 5)$
B. $a\,(a^2 + 5a)$
C. $a\,(a^2 + 5b)$
D. $a\,(a^2 + 5ab)$

a) What is the same about each example?
b) What is the different about each example?
c) Which examples will have a term with a^2 after the expression has been expanded? Try to do this by inspection.
d) Will any example have a term with ab after the expression has been expanded? Try to do this by inspection.
e) Expand A to D.

4)

a) Expand and write the powers in your answers from smallest to largest
   - i) $6m(m + 2)$
   - ii) $3r^2(2 + r)$

b) The following expression has 2 variables, a and b: $ab(a + 8b)$
   - i) Expand the expression and write your answer so that the powers of a go from smallest to largest.
   - ii) Now rewrite your answers so that the powers of b go from smallest to largest.

Worksheet 3.2

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1)
a) Expand:
ii) $7(p) =$
iii) $7(p^2) =$
iv) $7(3p) =$
v) $7(3 + p) =$
b) In each example what operation is between the 7 and the brackets?
c) Why do you get two terms in your answer to Q1a(iv)?</td><td>1)
a)
i) $7p$
ii) $7p^2$
iii) $21p$
iv) $21 + 7p$
b) Multiplication in all 4 cases
c) Because 3 and p are unlike terms</td></tr>
<tr><td>2) Look at examples A to D in the box below:
A. $x\,(x + 3)$
B. $4x\,(x + 3)$
C. $4x\,(x^2 + 3)$
D. $4x^2\,(x + 3)$
a) Write down the monomial for each example.
b) Write down the binomial for each example.
c) Which example will NOT have a term with x^2 after the expression has been expanded?
d) Expand A to D.
e) Look at your answers to C and D. What is the same and what is different?</td><td>2)<table><tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th></tr><tr><td>a)</td><td>x</td><td>$4x$</td><td>$4x$</td><td>$4x^2$</td></tr><tr><td>b)</td><td>$x + 3$</td><td>$x + 3$</td><td>$x^2 + 3$</td><td>$x + 3$</td></tr></table>c) C
d)
A. $x^2 + 3x$
B. $4x^2 + 12x$
C. $4x^3 + 12x$
D. $4x^3 + 12x^2$
e) Same: First term is $4x^3$
Different: Second term is $12x$ and $12x^2$</td></tr>
<tr><td>3) Look at examples A to D in the box below:
A. $a\,(a^2 + 5)$
B. $a\,(a^2 + 5a)$
C. $a\,(a^2 + 5b)$
D. $a\,(a^2 + 5ab)$
a) What is the same about each example?
b) What is the different about each example?
c) Which examples will have a term with a^2 after the expression has been expanded? Try to do this by inspection.
d) Will any example have a term with ab after the expression has been expanded? Try to do this by inspection.
e) Expand A to D.</td><td>3)
a) Monomial is always a; the first term in the bracket is always a^2; operation in bracket is addition; second term in bracket contains 5.
b) The second term in the bracket, number of variables in the binomial
c) B and D
d) Yes, C
e)
A. $a^3 + 5a$
B. $a^3 + 5a^2$
C. $a^3 + 5ab$
D. $a^3 + 5a^2b$</td></tr>
<tr><td>4)
a) Expand and write the powers in your answers from smallest to largest
i) $6m(m + 2)$
ii) $3r^2(2 + r)$
b) The following expression has 2 variables, a and b: $ab(a + 8b)$
i) Expand the expression and write your answer so that the powers of a go from smallest to largest.
ii) Now rewrite your answers so that the powers of b go from smallest to largest.</td><td>4)
a)
i) $12m + 6m^2$
ii) $6r^2 + 3r^3$
b)
i) $8ab^2 + a^2b$
ii) $a^2b + 8ab^2$</td></tr>
</table>

Worksheet 3.3

This worksheet focuses on using the distributive law working left to right as well as right to left, binomials include positive and negatives.

Questions

1) Multiply out:
   a) $5(m+2) =$
   b) $2(m-2) =$
   c) $5m(m-2) =$

2) Insert the missing values (☐) to make the following statements true:
   a) $2(x - \square) = 2x - 10$
   b) $2x(\square - 5) = 2x^2 - 10x$
   c) $2x^2(\square - 5) = 2x^3 - \square$

3) Say whether each statement is TRUE or FALSE. If the statement is false, change the *right* side of the is equal sign to make the statement true.
   a) $3(p+2) = 3p + 6$
   b) $2(m+1) = 2m + 1$
   c) $-5(a+2) = -5a + 10$
   d) $6(2x+7) = 12x + 13$

4) Fix the part on the right of the is equal to sign to show the correct way to use the distributive law
   a) $9(m+2) = 9(2m)$
   b) $49 - 14d = 7(7-2)$

5) Column A contains examples of monomials multiplied by binomials. Column B contains expanded versions.
   a) Match the columns.
   b) Some examples don't have a partner. You will need to produce the matching partner.

Column A	
1.	$4(x-2)$
2.	$2(x-4)$
3.	$x(2-4x)$
4.	$2x(x-4)$
5.	$2x(4-x)$

Column B	
A	$2x^2 - 8x$
B	$4x - 8$
C	$4x - 2$
D	$8x - 2x^2$
E	$2x - 8$

Worksheet 3.3

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) Multiply out:
a) $5(m+2)=$
b) $2(m-2)=$
c) $5m(m-2)=$</td><td>1)
a) $5m+10$
b) $2m-4$
c) $5m^2-10m$</td></tr>
<tr><td>2) Insert the missing values ($\square$) to make the following statements true:
a) $2(x-\square)=2x-10$
b) $2x(\square-5)=2x^2-10x$
c) $2x^2(\square-5)=2x^3-\square$</td><td>2)
a) 5
b) x
c) $x; 10x^2$</td></tr>
<tr><td>3) Say whether each statement is TRUE or FALSE. If the statement is false, change the <i>right</i> side of the is equal sign to make the statement true.
a) $3(p+2)=3p+6$
b) $2(m+1)=2m+1$
c) $-5(a+2)=-5a+10$
d) $6(2x+7)=12x+13$</td><td>3)
a) True
b) False, $2m+2$
c) False, $-5a-10$
d) False, $12x+42$</td></tr>
<tr><td>4) Fix the part on the right of the is equal to sign to show the correct way to use the distributive law
a) $9(m+2)=9(2m)$
b) $49-14d=7(7-2)$</td><td>4)
a) $9m+18$
b) $7(7-2d)$</td></tr>
<tr><td>5) Column A contains examples of monomials multiplied by binomials. Column B contains expanded versions.
a) Match the columns.
b) Some examples don’t have a partner. You will need to produce the matching partner.
<table>
<tr><th colspan="2">Column A</th></tr>
<tr><td>1.</td><td>$4(x-2)$</td></tr>
<tr><td>2.</td><td>$2(x-4)$</td></tr>
<tr><td>3.</td><td>$x(2-4x)$</td></tr>
<tr><td>4.</td><td>$2x(x-4)$</td></tr>
<tr><td>5.</td><td>$2x(4-x)$</td></tr>
</table>
<table>
<tr><th colspan="2">Column B</th></tr>
<tr><td>A</td><td>$2x^2-8x$</td></tr>
<tr><td>B</td><td>$4x-8$</td></tr>
<tr><td>C</td><td>$4x-2$</td></tr>
<tr><td>D</td><td>$8x-2x^2$</td></tr>
<tr><td>E</td><td>$2x-8$</td></tr>
</table>
</td><td>5)
a)
1. B
2. E
3. No match
4. A
5. D
b)
Partner for 3:
$x(2-4x)=2x-4x^2$ or
$x(2-4x)=-4x^2+2x$
Partner for C:
$4x-2=2(2x-1)$</td></tr>
</table>

Worksheet 3.4

This worksheet focuses on using the distributive law working left to right as well as right to left, binomials include positives and negatives.

Questions

1) Multiply out:
   a) $5(p-3)=$
   b) $2(-p+3)=$
   c) $5p(p-3)=$

2) Insert the missing values (☐) to make the following statements true:
   a) $3(a-\square)=3a-12$
   b) $3a(\square-5)=3a^2-15a$
   c) $3a(\square-\square)=10a^2-18a$

3) Say whether each statement is TRUE or FALSE. If the statement is false, change the *right* side of the equal sign to make the statement true.
   a) $5(a+7)=5a+12$
   b) $2(m-1)=2m-1$
   c) $7(1-3b)=7-3b$
   d) $4(y-3x)=-12x+4y$

4) Fix the part on the right of the equal sign to show the correct use of the distributive law:
   a) $6b+10e=3(2b+3e)$
   b) $12x-4=4(3x-0)$

5) Column A contains expressions. Column B contains monomials multiplied by binomials.
   a) Match the columns.
   b) Some examples don't have a partner. You will need to produce the matching partner.

Column A	
1.	$3p^2-6p$
2.	$2p-10$
3.	$3p-3$
4.	$6p-2p^2$
5.	$3p+9$

Column B	
A	$3(p-1)$
B	$2p(3-p)$
C	$3p(2-p)$
D	$3p(p-2)$
E	$3(p+3)$

Worksheet 3.4

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) Multiply out:
a) $5(p-3)=$
b) $2(-p+3)=$
c) $5p(p-3)=$</td><td>1)
a) $5p-15$
b) $-2p+6$
c) $5p^2-15p$</td></tr>
<tr><td>2) Insert the missing values (☐) to make the following statements true:
a) $3(a-\square)=3a-12$
b) $3a(\square-5)=3a^2-15a$
c) $3a(\square-\square)=10a^2-18a$</td><td>2)
a) 4
b) a
c) $\frac{10}{3}a;\ 6$</td></tr>
<tr><td>3) Say whether each statement is TRUE or FALSE. If the statement is false, change the right side of the equal sign to make the statement true.
a) $5(a+7)=5a+12$
b) $2(m-1)=2m-1$
c) $7(1-3b)=7-3b$
d) $4(y-3x)=-12x+4y$</td><td>3)
a) False, $5a+35$
b) False, $2m-2$
c) False, $7-21b$
d) True</td></tr>
<tr><td>4) Fix the part on the right of the equal sign to show the correct use of the distributive law:
a) $6b+10e=3(2b+3e)$
b) $12x-4=4(3x-0)$</td><td>4)
a) $2(3b+\mathbf{5}e)$
b) $4(3x-\mathbf{1})$</td></tr>
<tr><td>5) Column A contains expressions. Column B contains monomials multiplied by binomials.
a) Match the columns.
b) Some examples don't have a partner. You will need to produce the matching partner.
<table>
<tr><th colspan="2">Column A</th></tr>
<tr><td>1.</td><td>$3p^2-6p$</td></tr>
<tr><td>2.</td><td>$2p-10$</td></tr>
<tr><td>3.</td><td>$3p-3$</td></tr>
<tr><td>4.</td><td>$6p-2p^2$</td></tr>
<tr><td>5.</td><td>$3p+9$</td></tr>
</table>
<table>
<tr><th colspan="2">Column B</th></tr>
<tr><td>A</td><td>$3(p-1)$</td></tr>
<tr><td>B</td><td>$2p(3-p)$</td></tr>
<tr><td>C</td><td>$3p(2-p)$</td></tr>
<tr><td>D</td><td>$3p(p-2)$</td></tr>
<tr><td>E</td><td>$3(p+3)$</td></tr>
</table>
</td><td>5)
a)
1. D
2. No Match
3. A
4. B
5. E
b)
Partner for 2: $2p-10=2(p-5)$
Partner for C: $3p(2-p)=6p-3p^2$</td></tr>
</table>

Worksheet 3.5

In this worksheet you will focus on: using the distributive law when monomials are positive and binomials contain negative numbers.

Questions

1)

a) Expand: $3(p-2)$

b) Expand: $3(2-p)$

c) Write down 3 things that are the same in Q1a and Q1b.

d) Write down 2 things that are different in Q1a and Q1b.

e) If $p=5$, will you get the same answer for Q1a and Q1b?

Conventions for writing answers involving expressions:

1) Use alphabetical order for terms
e.g. The expression $5+3b+a$ should be written as:
$a+3b+5$
- Write the variables in alphabetical order
- Write constants last

2) If there is more than one variable:
e.g. $9c+\ 5ac-2a-3$ is written as $5ac-2a+9c-3$
- Write the term with more than one variable first

e.g. $2b \times 4ab \times b$ is written as $8ab^3$
- Write coefficient first
- Write variables in alphabetical order

3) Write answers in descending powers of the variable (from largest to smallest) OR in ascending powers (from smallest to largest)
e.g. $5de^3+7d^2e^2$ has been written in descending powers of e and in ascending powers of d.

2) Look at examples A and B in the box below:

A. $m(2-m)$
B. $m(-m+2)$

a) Substitute $m=1$ in A and B. Do you get the same answer?

b) Choose another value for m and substitute in A and B. Do you get the same answer?

c) Multiply out A and B.

d) Are the simplified expressions the same? Explain.

3) In this question we are going to compare $5(4-x)$ and $5(x-4)$.

a) Multiply out:
   i) $5(4-x)$
   ii) $5(x-4)$

b) What is the same about the expanded expressions for Q3a(i) and Q3a(ii) and what is different?

c) If $x=2$, will you get the same answer for the two expressions?

4) Look at examples A to C in the box below:

A. $3t(t-2)$
B. $3t(2-t)$
C. $(2-t)3t$

a) Substitute $t=5$ in A, B and C.

b) Which examples give the same answer? Why does this happen?

c) Expand A, B and C. Write your answers in ascending powers of t.

d) Are all the expanded expressions the same? Explain.

5) Expand. Write your answers in ascending powers of d.

a) $de(e^2-2d)$ b) $de(-2d+e^2)$ c) $de(-2d-e^2)$ d) $de(-e^2-2d)$

Worksheet 3.5

Answers

Questions	Answers
1) a) Expand: $3(p-2)$ b) Expand: $3(2-p)$ c) Write down 3 things that are the same in Q1a and Q1b. d) Write down 2 things that are different in Q1a and Q1b. e) If $p=5$, will you get the same answer for Q1a and Q1b?	1) a) $3(p-2)=3p-6$ b) $3(2-p)=6-3p$ c) Same: Monomial is multiplied by a binomial; the monomial is 3 ; the exponent of p in the answers is 1 d) Different: The binomial in Q1a is variable p subtract constant 2 (i.e. $p-2$); in Q1b the binomial is constant 2 subtract variable p (i.e. $2-p$); the answers of Q1a and Q1b are different (i.e. for Q1a is $3p-6$, and for Q1b is $6-3p$) e) No. If $p=5$ in Q1a, the answer is 9. If $p=5$ in Q1b, the answer is -9.
2) Look at examples A and B in the box below: A. $m(2-m)$ B. $m(-m+2)$ a) Substitute $m=1$ in A and B. Do you get the same answer? b) Choose another value for m and substitute in A and B. Do you get the same answer? c) Multiply out A and B. d) Are the multiplied out expressions the same? Explain.	2) a) A:If $m=1$, then $1(2-1)=1$, and B: if $m=1$, then $1(-1+2)=1$. Same answer. b) Own choice: A: If $m=2$, then $2(2-2)=0$, and B: If $m=2$, then $2(-2+2)=0$. Same answer. c) A. $m(2-m)=2m-m^2$ B. $m(-m+2)=-m^2+2m$ d) Yes. The monomials are the same. The binomials are the same, i.e. $2-m=-m+2$
3) In this question we are going to compare $5(4-x)$ and $5(x-4)$. a) Multiply out: i) $5(4-x)$ ii) $5(x-4)$ b) What is the same about the expanded expressions for Q3a(i) and Q3a(ii) and what is different? c) If $x=2$, will you get the same answer for the two expressions?	3) a) i) $5(4-x)=20-5x$ ii) $5(x-4)=5x-20$ b) Same: They are the product of a monomial and a binomial. The monomial is 5 in both cases. Different: The binomial in Q3a(i) is $4-x$ and the binomial in Q3a($x-4x$ c) No. If $x=2$, answer to (i) is 10; answer to (ii) is -10.
4) Look at examples A to C in the box below: A. $3t(t-2)$ B. $3t(2-t)$ C. $(2-t)3t$ a) Substitute $t=5$ in A, B and C. b) Which examples give the same answer? Why does this happen? d) Expand A, B and C. Write your answers in ascending powers of t. c) Are all the expanded expressions the same? Explain.	4) a) A: $3(5)(5-2)=15(3)=45$ B: $3(5)(2-5)=15(-3)=-45$ C: $(2-5)3(5)=(-3)15=-45$ b) Examples B and C. The monomials are both 15. The binomials are both -3. Multiplication is commutative: $15(-3)=(-3)15$ c) A: $3t(t-2)=3t^2-6t=-6t+3t^2$ B: $3t(2-t)=6t-3t^2$ C: $(2-t)3t=6t-3t^2$ d) No. Only B and C are the same: multiplication is commutative and the monomials and binomials are the same. In A the terms in the binomial are swopped around and subtraction is not commutative i.e. $(t-2)\neq(2-t)$.
5) Expand. Write your answers in ascending powers of d. a) $de(e^2-2d)$ b) $de(-2d+e^2)$ c) $de(-2d-e^2)$ d) $de(-e^2-2d)$	5) a) $de(e^2-2d)=de^3-2d^2e$ b) $de(-2d+e^2)=de^3-2d^2e$ c) $de(-2d-e^2)=-de^3-2d^2e$ d) $de(-e^2-2d)=-de^3-2d^2e$

Worksheet 3.6

In this worksheet you will focus on: using the distributive law when monomials are positive and binomials contain negative numbers.

Questions

1)
   a) Expand: $2(p-3)$
   b) Expand: $2(3-p)$
   c) Write down 3 things that are the same in Q1a and Q1b.
   d) Write down 2 things that are different in Q1a and Q1b.
   e) If $p=5$, will you get the same answer for Q1a and Q1b?

2) In this question we are going to compare $4(x-5)$ and $4(5-x)$
   a) Expand:
      i) $4(x-5)$
      ii) $4(5-x)$
   b) What is the same about the expanded expressions for Q2a(i) and Q2a(ii) and what is different?
   c) If $x=2$, will you get the same answer for the two expressions?

3) Look at examples A to C in the box below:

   A. $3y(2-y)$
   B. $3y(y-2)$
   C. $(2-y)(3y)$

   a) Substitute $y=3$ in A, B and C.
   b) Which examples give the same answer? Why does this happen?
   c) Expand A, B and C. Write your answers in descending powers of y.
   d) Are all the expanded expressions the same? Explain.

4) Expand. Write your answers in descending powers of b.
   a) $ab(b^2-2a)$
   b) $ab(-2a+b^2)$
   c) $ab(-2a-b^2)$
   d) $(-b^2-2a)(ab)$

Worksheet 3.6

Answers

Questions	Answers
1) a) Expand: $2(p-3)$ b) Expand: $2(3-p)$ c) Write down 3 things that are the same in Q1a and Q1b. d) Write down 2 things that are different in Q1a and Q1b. e) If $p=5$, will you get the same answer for Q1a and Q1b?	1) a) $2(p-3)=2p-6$ b) $2(3-p)=6-2p$ c) Same: • The monomial is multiplied by a binomial • The monomial is 2 in Q1a and Q1b • The exponent of p in the bracket and in the answers of Q1a and Q1b is 1 d) Different: • The binomial in Q1a is variable p subtract constant 3 (i.e. $p-3$), whilst the binomial in Q1b is constant 3 subtract variable p (i.e. $3-p$) • The answers of Q1a and Q1b are different (i.e. for Q1a is $2p-6$, and for Q1b is $6-2p$) e) No. When $p=5$ Q1a, the answer is 4. When $p=5$ in Q1b, the answer is -4.
2) In this question we are going to compare $4(x-5)$ and $4(5-x)$: a) Expand: i) $4(x-5)$ ii) $4(5-x)$ b) What is the same about the expanded expressions for Q2a(i) and Q2a(ii) and what is different? c) If $x=2$, will you get the same answer for the two expressions?	2) a) i) $4(x-5)=4x-20$ ii) $4(5-x)=20-4x$ b) They are both the product of a monomial and a binomial. The binomial in (i) is $x-5$ and the binomial in (ii) is $5-x$ so the signs are different. c) No. If $x=2,\ 4(2)-20=-12$ and $20-4(2)=12$
3) Look at examples A to C in the box below: A. $3y(2-y)$ B. $3y(y-2)$ C. $(2-y)(3y)$ a) Substitute $y=3$ in A, B and C. b) Which examples give the same answer? Why does this happen? c) Expand A, B and C. Write your answers in descending powers of y. d) Are all the expanded expressions the same? Explain.	3) a) If $y=3$ in A, then $3(3)(2-3)=9(-1)=-9$ If $y=3$ in B, then $3(3)(3-2)=9(1)=9$ If $y=3$ in C, then $(2-3)3(3)=-1(9)=-9$ b) Examples A and C. The monomials are the same and the binomials are the same. c) A. $3y(2-y)=6y-3y^2=-3y^2+6y$; B. $3y(y-2)=3y^2-6y$; C. $(2-y)3y=6y-3y^2=-3y^2+6y$ d) No. Only A and C of the expanded expressions are the same because multiplication is commutative and the monomials and binomials are the same. In B the terms in the binomial are swopped around and subtraction is not commutative i.e. $(2-y)\neq(y-2)$.
4) Expand. Write your answers in descending powers of b. a) $ab(b^2-2a)$ b) $ab(-2a+b^2)$ c) $ab(-2a-b^2)$ d) $(-b^2-2a)(ab)$	4) a) $ab(b^2-2a)=ab^3-a^2b$ b) $ab(-2a+b^2)=ab^3-2a^2b$ c) $ab(-2a-b^2)=-ab^3-2a^2b$ d) $(-b^2-2a)(ab)=-ab^3-2a^2b$

Worksheet 3.7

In this worksheet you will focus on: using the distributive law when monomials are positive or negative and binomials contain negative and positive numbers.

Questions

1) Look at examples A and B in the box below:

A. $3(p+2)$
B. $-3(p+2)$

a) Write down the monomials in A and B.
b) Write down the binomials in A and B.
c) When you multiply out each expression, what will be the sign of the constant term?
d) Multiply out A and B.

2) Look at example A and B in the box below:

A. $k(5-k)$
B. $-k(5-k)$

a) Substitute $k=3$ in A and B. Do you get the same answer?
b) Choose a negative value for k and substitute in A and B. Do you get the same answer?
c) Multiply out A and B.
d) Are the multiplied out expressions the same? Explain.

3) Look at examples A to C in the box below:

A. $-3b(b+6)$
B. $-3b(6+b)$
C. $(6+b)(-3b)$

a) Substitute $b=4$ in A, B and C.
b) Which examples give the same answer? Why does this happen?
c) Expand A, B and C. Write your answers in descending powers of b.
d) Are the expanded expressions the same? Explain.

4) Simplify. Write your answers in descending powers of e.

a) $-de(e^2-2d)$
b) $-de(2d-e^2)$
c) $-de(-2d+e^2)$
d) $-de(-2d-e^2)$
e) $(e^2-2d)(-de)$
f) $(-e^2+2d)\,(-de)$

Worksheet 3.7

Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) Look at examples A and B in the box below:
A. $3(p+2)$
B. $-3(p+2)$

a) Write down the monomials in A and B.
b) Write down the binomials in A and B.
c) When you multiply out each expression, what will be the sign of the constant term?
d) Multiply out A and B.</td><td>1)<table><tr><th></th><th>a) Monomials</th><th>b) Binomials</th></tr><tr><td>A</td><td>3</td><td>$p+2$</td></tr><tr><td>B</td><td>-3</td><td>$p+2$</td></tr></table>c) The constant will be positive in A and negative in B
d) A: $3(p+2)=3p+6$
B: $-3(p+2)=-3p-6$</td></tr>
<tr><td>2) Look at example A and B in the box below:
A. $k(5-k)$
B. $-k(5-k)$

a) Substitute $k=3$ in A and B. Do you get the same answer?
b) Choose a negative value for k and substitute in A and B. Do you get the same answer?
c) Multiply out A and B.
d) Are the multiplied out expressions the same? Explain.</td><td>2)
a) If $k=3$, then $3(5-3)=6$, and $-3(5-3)=-6$. Not the same answer.
b) Own choice.
If $k=-2$, then $(-2)(5-(-2))=-14$, and $-(-2)\big(5-(-2)\big)=14$. Not the same answer.
c)
A. $k(5-k)=5k-k^2$
B. $-k(5-k)=-5k+k^2$
d) No, the monomials are different, one is positive, and one is negative.</td></tr>
<tr><td>3) Look at examples A to C in the box below:
A. $-3b(b+6)$
B. $-3b(6+b)$
C. $(6+b)(-3b)$

a) Substitute $b=4$ in A, B and C.
b) Which examples give the same answer? Why does this happen?
c) Expand A, B and C. Write your answers in descending powers of b.
d) Are the expanded expressions the same? Explain.</td><td>3)
a) If $b=4$, A gives $-3(4)(4+6)=-120$
B gives $-3(4)(6+4)=-120$
C gives $\big(6+(4)\big)\big(-3(4)\big)=-120$
b) All the examples give the same answer. The monomial is the same and the binomials produce the same answer due to the commutative property: $(b+6)=(6+b)$
c) A: $-3b(b+6)=-3b^2-18b$
B: $-3b(6+b)=-3b^2-18b$
C: $(6+b)(-3b)=-3b^2-18b$
d) Yes. See explanation in Q3b.</td></tr>
<tr><td>4) Simplify. Write your answers in descending powers of e.
a) $-de(e^2-2d)$
b) $-de(2d-e^2)$
c) $-de(-2d+e^2)$
d) $-de(-2d-e^2)$
e) $(e^2-2d)(-de)$
f) $(-e^2+2d)\ (-de)$</td><td>4)
a) $-de^3+2d^2e$
b) de^3-2d^2e
c) $-de^3+2d^2e$
d) de^3+2d^2e
e) $-de^3+2d^2e$
f) de^3-2d^2e</td></tr>
</table>

Worksheet 3.8

In this worksheet you will focus on: using the distributive law when monomials are positive or negative and binomials contain negative and positive numbers.

Questions

1) Look at examples A and B in the box below:

A. $7(v+2)$
B. $-7(v+2)$

   a) Write down the monomials in A and B.
   b) Write down the binomials in A and B.
   c) When you multiply out each expression, what will be the sign of the constant term?
   d) Multiply out A and B.

2) Look at example A and B in the box below:

A. $a(6-a)$
B. $-a(6-a)$

   a) Substitute $a=5$ in A and B. Do you get the same answers?
   b) Choose a negative value for a and substitute in A and B. Do you get the same answers?
   c) Multiply out A and B.
   d) Are the expanded expressions the same? Explain.

3) Look at examples A to C in the box below:

A. $-2b(b+9)$
B. $-2b(9+b)$
C. $(9+b)(-2b)$

   a) Substitute $b=2$ in A, B and C.
   b) Which examples give the same answer? Why does this happen?
   c) Expand A, B and C. Write your answers in descending powers of b.
   d) Are the expanded expressions the same? Explain.

4) Multiply out. Write your answers in descending powers of a.
   a) $ad(a^2-2b)$
   b) $-ad(2d-a^2)$
   c) $(-ad)(-2d+a^2)$
   d) $-da(-2d-a^2)$
   e) $(a^2-2d)(-ad)$
   f) $(-a^2+2d)\,(-da)$

Worksheet 3.8

Answers

Questions	Answers
1) Look at examples A and B in the box below: A. $7(v+2)$ B. $-7(v+2)$ a) Write down the monomials in A and B. b) Write down the binomials in A and B. c) When you multiply out each expression, what will be the sign of the constant term? d) Multiply out A and B.	1) a) Monomials b) Binomials A 7 $v+2$ B -7 $v+2$ c) The constant will be positive in A and negative in B d) $7(v+2)=7v+14$ $-7(v+2)=-7v-14$
2) Look at example A and B in the box below: A. $a(6-a)$ B. $-a(6-a)$ a) Substitute $a=5$ in A and B. Do you get the same answers? b) Choose a negative value for a and substitute in A and B. Do you get the same answers? c) Multiply out A and B. d) Are the multiplied out expressions the same? Explain.	2) a) If $a=5$, then $5(6-5)=5$, and then $-5(6-5)=-5$. Not the same answer. b) Own choice. If $a=-2$, then $(-2)\big(6-(-2)\big)=-16$, and $-(-2)\big(6-(-2)\big)=16$. Not the same answer. c) A. $a(6-a)=6a-a^2$ B. $-a(6-a)=-6a+a^2$ d) No, the monomials are different, one is positive, and one is negative.
3) Look at examples A to C in the box below: A. $-2b(b+9)$ B. $-2b(9+b)$ C. $(9+b)(-2b)$ a) Substitute $b=2$ in A, B and C. b) Which examples give the same answer? Why does this happen? c) Expand A, B and C. Write your answers in descending powers of b. d) Are the expanded expressions the same? Explain.	3) a) If $b=2$, A gives $-2(\ 2)\big((2)+9\big)=-44$ B gives $-2(\ 2)\big(9+(2)\big)=-44$ C gives $\big(9+(\ 2)\big)\big(-2(\ 2)\big)=-44$ b) All the examples give the same answer. The monomial is the same and the binomials produce the same answer due to the commutative property: $(b+9)=(9+b)$ c) A: $-2b(b+9)=-2b^2-18b$ B: $-2b(9+b)=-2b^2-18b$ C: $(9+b)(-2b)=-2b^2-18b$ d) Yes. See explanation in Q3b.
4) Multiply out. Write your answers in descending powers of a. a) $ad(a^2-2b)$ b) $-ad(2d-a^2)$ c) $(-ad)(-2d+a^2)$ d) $-da(-2d-a^2)$ e) $(a^2-2d)(-ad)$ f) $(-a^2+2d)\ (-da)$	4) a) a^3d-2ad^2 b) a^3d-2ad^2 c) $-a^3d+2ad^2$ d) a^3d+2ad^2 e) $-a^3d+2ad^2$ f) a^3d-2ad^2

Worksheet 3.9

In this worksheet you will focus on: using the distributive law when there are 2 or more terms in the brackets, monomials are positive or negative and terms in the brackets contain positive and/or negative and numbers.

Questions

1) Look at examples A, B and C in the box below:

A. $2(m+n)$
B. $2(m+3n)$
C. $2(m-3n)$

a) How many terms are in each bracket?
b) Predict how many terms there will be in the final answer for each example.
c) Expand A to C. Is your answer in Q1b correct?

2) Look at examples A, B and C in the box below:

A. $2(m+3n+4p)$
B. $2(m-3n+4p)$
C. $2(m+3n-4p)$

a) How many terms are in each bracket?
b) Predict how many terms there will be in the final answer for each example.
c) Expand A to D. Is your answer in Q2b correct?

3) Expand:

a) $-2(f+g+h)$
b) $(f+g+h)(-2)$
c) $e(f+g+h)$
d) $(f+g+h)e$
e) $-e(f+g+h)$
f) $(f+g+h)(-e)$
g) $-e(f-g+h)$
h) $(f-g-h)(-e)$
i) $-4e(f+g+h)$
j) $(f+g+h)(-4e)$

4) Multiply out:

a) $t(t^2+t+3)$
b) $(t^2+t+3)t$
c) $-t(t^2+t+3)$
d) $(t^2+t+3)(-t)$

5) Multiply out. Write your answers in descending powers of s for Q5a to Q5c, and in descending powers of p for Q5d to Q5f.

a) $(s-5)3st$
b) $(s-5)(-3st)$
c) $(s^2+2t+3)(-3st)$
d) $-pr(p^2+2p)$
e) $-pr(p^2-2p)$
f) $-pr(-p^2-2p+5)$

Worksheet 3.9

Answers

Questions	Answers
1) Look at examples A, B and C in the box below: A. $2(m+n)$ B. $2(m+3n)$ C. $2(m-3n)$ a) How many terms are in each bracket? b) Predict how many terms there will be in the final answer for each example. c) Expand A to C. Is your answer in Q1b correct?	1) a) 2 b) 2 c) A. $2m+2n$ B. $2m+6n$ C. $2m-6n$ Yes it is correct
2) Look at examples A, B and C in the box below: A. $2(m+3n+4p)$ B. $2(m-3n+4p)$ C. $2(m+3n-4p)$ a) How many terms are in each bracket? b) Predict how many terms there will be in the final answer for each example. c) Expand A to D. Is your answer in Q2b correct?	2) a) 3 b) 3 c) A: $2m+6n+8p$ B: $2m-6n+8p$ C: $2m+6n-8p$ Yes it is correct
3) Expand: a) $-2(f+g+h)$ b) $(f+g+h)(-2)$ c) $e(f+g+h)$ d) $(f+g+h)e$ e) $-e(f+g+h)$ f) $(f+g+h)(-e)$ g) $-e(f-g+h)$ h) $(f-g-h)(-e)$ i) $-4e(f+g+h)$ j) $(f+g+h)(-4e)$	3) a) $-2f-2g-2h$ b) $-2f-2g-2h$ c) $ef+eg+eh$ d) $ef+eg+eh$ e) $-ef-eg-eh$ f) $-ef-eg-eh$ g) $-ef+eg-eh$ h) $-ef+eg+eh$ i) $-4ef-4eg-4eh$ j) $-4ef-4eg-4eh$
4) Multiply out: a) $t(t^2+t+3)$ b) $(t^2+t+3)t$ c) $-t(t^2+t+3)$ d) $(t^2+t+3)(-t)$	4) a) t^3+t^2+3t b) t^3+t^2+3t c) $-t^3-t^2-3t$ d) $-t^3-t^2-3t$
5) Multiply out. Write your answers in descending powers of s for Q5a to Q5c, and in descending powers of p for Q5d to Q5f. a) $(s-5)3st$ b) $(s-5)(-3st)$ c) $(s^2+2t+3)(-3st)$ d) $-pr(p^2+2p)$ e) $-pr(p^2-2p)$ f) $-pr(-p^2-2p+5)$	5) a) $3s^2t-15st$ b) $-3s^2t+15st$ c) $-3s^3t-6st^2-9st$ d) $-p^3r-2p^2r$ e) $-p^3r+2p^2r$ f) p^3r+2p^2r-5pr

Worksheet 3.10

In this worksheet you will focus on: using the distributive law when there are 2 or more terms in the brackets, monomials are positive or negative and terms in the brackets contain positive and/or negative and numbers.

Questions

1) Look at examples A, B, C and D in the box below:

A. $3(d+2e+4f)$
B. $3(d-2e+4f)$
C. $3(d+2e-4f)$
D. $3(d-2e-4f)$

a) How many terms are in each bracket?
b) Predict how many terms there will be in the final answer for each example.
c) Expand A to D. Is your answer in Q1b correct?

2) Multiply out:
a) $w(x+y+z)$
b) $(x+y+z)w$
c) $x(x+y+z)$
d) $-x(x+y+z)$
e) $-x(x-y+z)$
f) $-4x(x-y-z)$

3) Multiply out:
a) $3a(a^2+a+5)$
b) $2a(a^2-a+5)$
c) $-a(a^2-a+5)$
d) $(a^2-a+5)(-a)$

4) Multiply out. Write your answers in descending powers of x for Q4a to Q4c, and in descending powers of c for Q4d to Q4f.
a) $(x-7)3xy$
b) $(x-7)(-3xy)$
c) $(x^2-7x+3)(-3xy)$
d) $-cd(c^2-2c)$
e) $-cd(-c^2-2c)$
f) $-cd(-c^2-2c+7)$

Worksheet 3.10

Answers

Questions	**Answers**
1) Look at examples A, B, C and D in the box below: A. $3(d+2e+4f)$ B. $3(d-2e+4f)$ C. $3(d+2e-4f)$ D. $3(d-2e-4f)$ a) How many terms are in each bracket? b) Predict how many terms there will be in the final answer for each example. c) Expand A to D. Is your answer in Q1b correct?	1) a) 3 b) 3 c) A. $3d+6e+12f$ B. $3d-6e+12f$ C. $3d+6e-12f$ D. $3d-6e-12f$ Yes it is correct
2) Multiply out: a) $w(x+y+z)$ b) $(x+y+z)w$ c) $x(x+y+z)$ d) $-x(x+y+z)$ e) $-x(x-y+z)$ f) $-4x(x-y-z)$	2) a) $wx+wy+wz$ b) $xw+yw+zw$ c) $x^2+xy+xz$ d) $-x^2-xy-xz$ e) $-x^2+xy-xz$ f) $-4x^2+4xy+4xz$
3) Multiply out: a) $3a(a^2+a+5)$ b) $2a(a^2-a+5)$ c) $-a(a^2-a+5)$ d) $(a^2-a+5)(-a)$	3) a) $3a^3+3a^2+15a$ b) $2a^3-2a^2+10a$ c) $-a^3+a^2-5a$ d) $-a^3+a^2-5a$
4) Multiply out. Write your answers in descending powers of x for Q4a to Q4c, and in descending powers of c for Q4d to Q4f. a) $(x-7)3xy$ b) $(x-7)(-3xy)$ c) $(x^2-7x+3)(-3xy)$ d) $-cd(c^2-2c)$ e) $-cd(-c^2-2c)$ f) $-cd(-c^2-2c+7)$	4) a) $3x^2y-21xy$ b) $-3x^{2y}+21xy$ c) $-3x^3y+21x^2y-9xy$ d) $-c^3d+2c^2d$ e) c^3d+2c^2d f) c^3d+2c^2d-7cd

Worksheet 4.1

This worksheet focuses on simplifying algebraic expressions, substituting into algebraic expressions and working with verbal and algebraic expressions.

Questions

1) Simplify:
   a) $a + a + a$
   b) $8b \times 3b$
   c) $7a \times 4b$
   d) $(p)(q) - r$
   e) $-3s(-4t)$

2) Calculate the value of:
   a) $3ab$ if $a = 3$ and $b = 4$
   b) $x + 10$ if $x = -5$
   c) $3(2w + 5)$ if $w = 2$

3)
   a) Write $h - 9$ as a verbal expression
   b) Write ‘thirteen more than a number’ as an algebraic expression

4) Calculate the value of:
   a) $3ab$ if $a = 3$ and $b = 4$
   b) $x + 10$ if $x = -5$
   c) $3(2w + 5)$ if $w = 2$

5) Simplify:
   a) $r - 7r + r$
   b) $7b + 5b - 3a$
   c) $5x + 6 + 2x + 5$
   d) $-15y - 6y$
   e) $5d + 2e + 8 + 7d - e + 8$

6) Say whether each statement is TRUE or FALSE:
   a) $8xy$ and $8yx$ are like terms
   b) $3(x + 2y) = 3x + 2y$
   c) $32 + 16d = 8(4 + 2d)$
   d) $10x - 36y + 2x + y = 12x + 36y$

Worksheet 4.1

Answers

Questions	Answers
1) Simplify: a) $a + a + a$ b) $8b \times 3b$ c) $7a \times 4b$ d) $(p)(q) - r$ e) $-3s(-4t)$	1) a) $3a$ b) $24b^2$ c) $28ab$ d) $pq - r$ e) $12st$
2) Calculate the value of: a) $3ab$ if $a = 3$ and $b = 4$ b) $x + 10$ if $x = -5$ c) $3(2w + 5)$ if $w = 2$	2) a) $3(3)(4) = 36$ b) $(-5) + 10 = 5$ c) $3(4 + 5) = 27$
3) a) Write $h - 9$ as a verbal expression b) Write 'thirteen more than a number' as an algebraic expression	3) Possible answers: a) Nine less than h or h subtract 9 b) $x + 13$ or $13 + x$
4) Simplify: a) $r - 7r + r$ b) $7b + 5b - 3a$ c) $5x + 6 + 2x + 5$ d) $-15y - 6y$ e) $5d + 2e + 8 + 7d - e + 8$	4) a) $-5r$ b) $-3a + 12b$ c) $7x + 11$ d) $-21y$ e) $12d + e + 16$
5) Say whether each statement is TRUE or FALSE: a) $8xy$ and $8yx$ are like terms b) $3(x + 2y) = 3x + 2y$ c) $32 + 16d = 8(4 + 2d)$ d) $10x - 36y + 2x + y = 12x + 36y$	5) a) True b) False c) True d) False

Worksheet 4.2

This worksheet focuses on simplifying algebraic expressions, substituting into algebraic expressions and working with verbal and algebraic expressions.

Questions

1) Simplify:
   a) $b + 2b$
   b) $\frac{8x}{4}$
   c) $-7a(4b)$
   d) $(p)(q) - (p)(r)$
   e) $3m - 6m$

2) Calculate the value of:
   a) $3a + b$ if $a = 3$ and $b = 4$
   b) $(x - 5) + 5$ if $x = -5$
   c) $3(6w + 4w)$ if $w = 2$

3)
   a) Write $4p + 3$ as a verbal expression
   b) Write ‘five less than a number’ as an algebraic expression

4) Simplify:
   a) $a - 3a + a$
   b) $6m + 3m - 2$
   c) $8x - 3 + 4x + 3$
   d) $-4j - 4j$
   e) $4xyz + xz + 2x - xyz - x - y$
   f) $a - 3a$

5) Say whether each statement is TRUE or FALSE:
   a) $6a - 3a - a - 12 = 3a - 12$
   b) $12(x + 2y + 2x) = 12(3x + 2y)$
   c) $6(d - e) = 6d - 6e$
   d) $4(2x - 3y) = -24xy$

Worksheet 4.2

Answers

Questions	Answers
1) Simplify: a) $b + 2b$ b) $\frac{8x}{4}$ c) $-7a(4b)$ d) $(p)(q) - (p)(r)$ e) $3m - 6m$	1) a) $3b$ b) $2x$ c) $-28ab$ d) $pq - pr$ e) $-3m$
2) Calculate the value of: a) $3a + b$ if $a = 3$ and $b = 4$ b) $(x - 5) + 5$ if $x = -5$ c) $3(6w + 4w)$ if $w = 2$	2) a) 13 b) -5 c) 60
3) a) Write $4p + 3$ as a verbal expression b) Write 'five less than a number' as an algebraic expression	3) Possible answers a) Three more than 4 multiplied by a number b) $x - 5$
4) Simplify: a) $a - 3a + a$ b) $6m + 3m - 2$ c) $8x - 3 + 4x + 3$ d) $-4j - 4j$ e) $4xyz + xz + 2x - xyz - x - y$	4) a) $-a$ b) $9m - 2$ c) $12x$ d) $-8j$ e) $3xyz + xz + x - y$
5) Say whether each statement is TRUE or FALSE: a) $6a - 3a - a - 12 = 3a - 12$ b) $12(x + 2y + 2x) = 12(3x + 2y)$ c) $6(d - e) = 6d - 6e$ d) $4(2x - 3y) = -24xy$	5) a) False b) True c) True d) False

Worksheet 4.3

In this worksheet you will focus on: adding, subtracting or multiplying algebraic expressions which have 2 terms in brackets.

Questions

1)

a) Which of these terms produce the same answer when they are simplified?
$25p;\quad 2\times 5p;\quad 2(5p);\quad 2p(5)$

b) Apply the distributive law: $3a(a+7)$

c) Spot the 2 errors and correct them:

$$\begin{aligned} &5+m(2\ +m)\\ &=5m(2+m)\\ &=10m+5m\\ &=15m \end{aligned}$$

2) This question focuses on the 6 expressions in the box.

A. $5k(k\ +\ 2)$
B. $(k\ +\ 2)5k$
C. $5+k(k\ +\ 2)$
D. $(k\ +\ 2)5+k$
E. $(k+\ 2)+5k$
F. $5(k\ +\ 2)k$

a) Look at the expressions carefully and answer these questions:
  i) In which expressions is k multiplied into the bracket?
  ii) In which expressions is 5 multiplied into the bracket?

b) Simplify each expression.

c) Which expressions have the same answer? Why does this happen?

3) Each expression below uses $2x$; x and 3. We have grouped them into 3 clusters.

A. $2x(x\ +\ 3)$
B. $2x+(x+3)$
C. $2x-(x+3)$

D. $(2x-x)+3$
E. $(2x-x)3$

F. $(2x-3)+x$
G. $(2x-3)x$

a) What is different between A, B and C?
b) What is different between D and E?
c) What is different between F and G?
d) What is the same and what is different between E and G?
e) Simplify A to G.
f) Try to do E in different way.
g) In which expressions are the brackets <u>not</u> needed?

4) Three expressions are given below:

A. $2x(x-y)$
B. $x+2x(x-y)$
C. $(x-y)2x+x$

a) Expand each expression.

b) For B, a classmate's answer is: $3x^2-3xy$. What did she do wrong?

Worksheet 4.3

Answers

Questions	Answers
1) a) Which of these terms produce the same answer when they are simplified? $25p$; $2 \times 5p$; $2(5p)$; $2p(5)$ b) Apply the distributive law: $3a(a+7)$ c) Spot the 2 errors and correct them: $5+m(2+m)$ $=5m(2+m)$ $=10m+5m$ $=15m$	1) a) These terms $2 \times 5p$; $2(5p)$; $2p(5)$ all produce 10. b) $3a^2+21a$ c) Line 2: $5+m$ is written as 5 and in line 3 the product of $5m$ and m is given as $5m$ instead of $5m^2$. This is what the answer should be: $5+m(2+m)=5+2m+m^2$
2) This question focuses on the 6 expressions in the box. A. $5k(k+2)$ B. $(k+2)5k$ C. $5+k(k+2)$ D. $(k+2)5+k$ E. $(k+2)+5k$ F. $5(k+2)k$ a) Look at the expressions carefully and answer these questions: i) In which expressions is k multiplied into the bracket? ii) In which expressions is 5 multiplied into the bracket? b) Simplify each expression. c) Which expressions have the same answer? Why does this happen?	2) a) i) A, B, C and F ii) A, B, D and F b) A. $5k^2+10k$ B. $5k^2+10k$ C. $5+k^2+2k=k^2+2k+5$ D. $6k+10$ E. $6k+2$ F. $5k^2+10k$ c) A, B and F: In A, monomial $5k$ is multiplied into binomial $k+2$ from the left; in B, $5k$ is multiplied into $k+2$ from the right; in C 5 of the monomial $5k$ is multiplied into $k+2$ from the right and then the product is multiplied by the variable k of $5k$.
3) Each expression below uses $2x$; x and 3. We have grouped them into 3 clusters. A. $2x(x+3)$ B. $2x+(x+3)$ C. $2x-(x+3)$ D. $(2x-x)+3$ E. $(2x-x)3$ F. $(2x-3)+x$ G. $(2x-3)x$ a) What is different between A, B and C? b) What is different between D and E? c) What is different between F and G? d) What is the same and what is different between E and G? e) Simplify A to G. f) Try to do E in different way. g) In which expressions are the brackets <u>not</u> needed?	3) a) In A, monomial $2x$ is multiplied into binomial $x+3$ from the left. In B, binomial $x+3$ is added to monomial $2x$ In C, binomial $x+3$ is subtracted from monomial 2 b) In D, 3 is added to $2x-x$, in E, $2x-x$ is multiplied by 3 from the right c) In F, x is added to $2x-3$, In G, $2x-3$ is multiplied by x from the right d) Same: E and G have the a binomial multiplied by monomial; $2x$ is the first term in the binomial; there is subtraction in both brackets Different: Binomial in E consists of like terms, but binomial in G consists of unlike terms. e) A. $2x^2+6x$ | B. $3x+3$ | C. $x-3$ | D. $x+3$ E. $3x$ | F. $3x-3$ | G. $2x^2-3x$ f) $6x-3x=3x$ or $(x)3=3x$ g) B, D and F
5) Three expressions are given below: A. $2x(x-y)$ B. $x+2x(x-y)$ C. $(x-y)2x+x$ a) Expand each expression. b) For B, a classmate's answer is: $3x^2-3xy$. What did she do wrong?	4) a) A. $2x^2-2xy$ B. $x+2x^2-2xy=2x^2-2xy+x$ C. $2x^2-2xy+x$ b) She added x and $2x$ first then applied the distributive law. She should have distributed $2x$ first.

Worksheet 4.4

In this worksheet you will focus on: adding, subtracting or multiplying in algebraic expressions which have 2 terms in brackets.

Questions

1)

a) Which of the following terms produce the same answer when simplified?
$3 \times 5x$; $3(5x)$; $5x(3)$; $3 + 5x$

b) Apply the distributive law: $2a(a + 7)$

c) Spot the 2 errors and work out the correct solution:

$3 + 2m(m + 2)$
$= 5m(m + 2)$
$= 5m^2 + 10$

2) This question focuses on the 6 expressions in the box.

A. $5k(k - 2)$
B. $(k - 2)5k$
C. $5 + k(k - 2)$
D. $(k - 2)5 + k$
E. $(k - 2) + 5k$
F. $5(k - 2)k$

a) Look at the expressions carefully and answer these questions:
   i) In which expressions is k multiplied into the bracket?
   ii) In which expressions is 5 multiplied into the bracket?

b) Simplify each expression.

c) Which expressions have the same answer? Why does this happen?

3) Each expression below uses $2a$; a and 3. We have grouped them into 3 clusters.

A. $2a(a + 3)$
B. $2a + (a + 3)$
C. $2a - (a + 3)$

D. $(2a - a) + 3$
E. $(2a - a)3$

F. $(2a - 3) + a$
G. $(2a - 3)a$

a) What is different between A, B and C?
b) What is different between D and E?
c) What is different between F and G?
d) What is the same and what is different between E and G?
e) Simplify A to G.
f) Try to do E in different way.
g) In which expressions are the brackets <u>not</u> needed?

4) Expand the following expressions:

a) $2x(x - y)$
b) $x + 2x(x - y)$
c) $(x - y)2x + x$
d) $2x(x - y) + y$

Worksheet 4.4

Answers

Questions	Answers
1) a) Which of the following terms produce the same answer when simplified? $3 \times 5x;\quad 3(5x);\quad 5x(3);\qquad 3 + 5x$ b) Apply the distributive law: $2a(a+7)$ c) Spot the 2 errors and work out the correct solution: $3 + 2m(m+2)$ $= 5m(m+2)$ $= 5m^2 + 10$	1) a) The following terms: $3 \times 5x;\ 3(5x);\ 5x(3)$ give$15x$. b) $2a^2 + 14a$ c) Line 2: $3 + 2m$ is written as $5m$, and in Line 4: the product of $5m$ and 2 is given as 10 instead of $10m$. This is what the answer should be: $3 + 2m(m+2) = 3 + 2m^2 + 4m$ $= 2m^2 + 4m + 3$
2) This question focuses on the 6 expressions in the box. A. $5k(k-2)$ B. $(k-2)5k$ C. $5 + k(k-2)$ D. $(k-2)5 + k$ E. $(k-2) + 5k$ F. $5(k-2)k$ a) Look at the expressions carefully and answer these questions: i) In which expressions is k multiplied into the bracket? ii) In which expressions is 5 multiplied into the bracket? b) Simplify each expression. c) Which expressions have the same answer? Why does this happen?	2) a) i) A, B, C and F ii) A, B, D and F b) A. $5k^2 - 10k$ B. $5k^2 - 10k$ C. $5 + k^2 - 2k$ D. $6k - 10$ E. $6k - 2$ F. $5k^2 - 10k$ c) A, B and F. In A, monomial $5k$ is multiplied into binomial $k-2$ from the left, in B, monomial $5k$ and binomial $k-2$ are just switched around. In C, constant 5 of the monomial $5k$ is first multiplied into binomial $k-2$, and then the product is is multiplied by the variable k of $5k$.
3) Each expression below uses $2a$; a and 3. We have grouped them into 3 clusters. A. $2a(a+3)$ B. $2a + (a+3)$ C. $2a - (a+3)$ D. $(2a-a)+3$ E. $(2a-a)3$ F. $(2a-3)+a$ G. $(2a-3)a$ a) What is different between A, B and C? b) What is different between D and E? c) What is different between F and G? d) What is the same and what is different between E and G? e) Simplify A to G. f) Try to do E in different way. g) In which expressions are the brackets <u>not</u> needed?	3) a) In A, monomial $2a$ is multiplied into binomial $a+3$ In B, binomial $a+3$ is added to monomial $2a$ In C, binomial $a+3$ is subtracted from monomial 2 b) In D, 3 is added to $2a-a$, in E, $2a-3$ is multiplied by 3 from the right c) In F, a is added to $2a-3$, in G , $2a-a$ multiplied by a d) Same: E and G have binomials multiplied by monomials; $2a$ is the first term in the binomial; there is subtraction in both brackets Different: The binomial in E consists of like terms, and they can be added to a single term before multiplying by 3.; the binomial in G has unlike terms. e) A. $2a^2 + 6a$ B. $3a + 3$ C. $a - 3$ D. $a + 3$ E. $3a$ F.$3a - 3$ G. $2a^2 - 3a$ f) $6a - 3a = 3a$ or $(a)3 = 3a$ g) B, D and F
4) Expand the following expressions: a) $2d(d-e)$ b) $d + 2d(d-e)$ c) $(d-e)2d + e$ d) $2d(d-e) + e$	4) a) $2d^2 - 2de$ b) $d + 2d^2 - 2de = 2d^2 - 2de + d$ c) $2d^2 - 2de + d$ d) $2d^2 - 2de + d$

Worksheet 4.5

In this worksheet you will focus on: adding, subtracting or multiplying algebraic expressions which have 2 terms in brackets, and include negatives

Questions

1) There are 4 different expressions in Column A. Find an equivalent expression for each in Column B. There may be more than one match.

Column A	
a)	$(a+2)3$
b)	$(a+2)-3$
c)	$(a+2)a+3$
d)	$(3+a)2$

Column B	
A.	$a(a+2)+3$
B.	$3(a+2)$
C.	$2(3+a)$
D.	$3a+6$
E.	$a+2-3$

2) Look at each pair of examples and do the following:

- Say what is the same about each expression in the pair
- Simplify each expression
- Are the answers in the pair the same or different?
- Say why the answers are the same or different

a) $3(m+1)$
b) $3(-m+1)$

c) $3(m+1)$
d) $3(-m+1)$

e) $-3(m+1)+3$
f) $-3(m+1)-3$

g) $(m+n)-2m+n$
h) $(m+n)(-2m)+n$

3) Multiply out and simplify:

a) $2p(p+r)$
b) $p+2p(p+r)$
c) $(p+r)2p+r$
d) $p-2p(p+r)$
e) $(p+2)p-2p$

4) Find the value of each expression if $j=1$ and $k=2$.

a) $(j+k)2j$
b) $2j(j+k)$

c) $(j+k)(-2j)$
d) $(j+k)-2j$
e) $(j+k)-kj$

f) $(j+k)+j+k$
g) $(j+k)-j+k$

Do any clusters (or groups) give the same answers? If so, why does this happen?

Worksheet 4.5
Answers

<table>
<tr><th>Questions</th><th>Answers</th></tr>
<tr><td>1) There are 4 different expressions in Column A. Find an equivalent expression for each in Column B. There may be more than one match.
<table><tr><th colspan="2">Column A</th></tr><tr><td>d)</td><td>$(a+2)3$</td></tr><tr><td>e)</td><td>$(a+2)-3$</td></tr><tr><td>f)</td><td>$(a+2)a+3$</td></tr><tr><td>e)</td><td>$(3+a)2$</td></tr></table>
<table><tr><th colspan="2">Column B</th></tr><tr><td>A.</td><td>$a(a+2)+3$</td></tr><tr><td>B.</td><td>$3(a+2)$</td></tr><tr><td>C.</td><td>$2(3+a)$</td></tr><tr><td>D.</td><td>$3a+6$</td></tr><tr><td>E.</td><td>$a+2-3$</td></tr></table></td><td>1)
a) B and D
b) E
c) A
d) C</td></tr>
<tr><td colspan="2">2) Question and answers are grouped together for Q2.</td></tr>
<tr><td colspan="2">Look at each pair of examples and do the following:
- Say what is the same about each expression in the pair
- Simplify each expression
- Are the answers in the pair the same or different?
- Say why the answers are the same or different

a) $3(m\ +1)$
b) $3(-m\ +1)$
- the monomials are the same
- $3m+3$ and $-3m-3$
- The answers are different
- The sign of m in Q2a is positive but in Q2b m is negative.
c) $(m\ +1)(-3)$
d) $(m\ +1)-3$
- the binomials are the same
- $-3m-3$ and $m-2$
- The answers are different
- In Q2c, $(m\ +1)$ is multiplied by -3 but in Q2d 3 is subtracted from $(m\ +1)$.
g) $-3(m\ +1)+3$
h) $-3(m\ +1)-3$
- the monomials and binomials are the same
- $-3m$ and$-3m-6$
- The answers are different
- In Q2e, 3 is added to $-3(m\ +1)$ but in Q2f, 3 is subtracted from$-3(m\ +1)$.

i) $(m+n)-2m+n$
j) $(m+n)(-2m)+n$
- the binomials are the same and the last term of each is $+n$.
- $-m+2n$ and $-2m^2-2mn+n$
- The answers are different
- In Q2g, $(m\ +n)$ is has $-2m$ added to it but in Q2h, $(m\ +n)$ is multiplied by $(-2m)$.</td></tr>
<tr><td>3) Multiply out and simplify:
a) $2p(p\ +r)$
b) $p+2p(p+r)$
c) $(p+r)2p+r$
d) $p-2p(p+r)$
e) $(p+2)p-2p$</td><td>3)
a) $2p^2+2pr$
b) $p+2p^2+2pr=2p^2+2pr+p$
c) $2p^2+2pr+p$
d) $p-2p^2-2pr=-2p^2-2pr+p$
e) $p^2+2p-2p=p^2$</td></tr>
<tr><td>4) Find the value of each expression if $j=1$ and $k=2$.
a) $(j+k)2j$
b) $2j(j+k)$
c) $(j+k)(-2j)$
d) $(j+k)-2j$
e) $(j+k)-kj$
f) $(j+k)+j+k$
g) $(j+k)-j+k$
Do any clusters (or groups) give the same answers? If so, why does this happen?</td><td>4)
a) $\big((1)+(2)\big)2(1)=6$
b) $2(1)\big((1)+(2)\big)=6$ Same answers. The same binomial is multiplied by the same monomial just from different sides.
c) $\big((1)+(2)\big)\big(-2(1)\big)=-6$
d) $\big((1)+(2)\big)-2(1)=1$
e) $\big((1)+(2)\big)-(2)(1)=1$ Same answers for Q4d and Q4e because $k=2$.
f) $\big((1)+(2)\big)+(1)+(2)=6$
g) $\big((1)+(2)\big)-(1)+(2)=4$</td></tr>
</table>

Worksheet 4.6

In this worksheet you will focus on: adding, subtracting or multiplying algebraic expressions which have 2 terms in brackets, and include negatives

Questions

1) Look at each pair of expressions and do the following:
   - Say what is the same about each expression in the pair
   - Simplify each expression
   - Are the answers in the pair the same or different?
   - Say why the answers are the same or different

a) $2(x + 3)$
b) $-2(x + 3)$

c) $(x + 3)(-2)$
d) $(x + 3) - 2$

e) $-2(x + 3) - 2$
f) $-2(x + 3) + 2$

g) $(b + c) - 2b + b$
h) $(b + c)(-2b) + b$

i) $(-d + e) - 2d(-d)$
j) $(-d + e)(-2d) - d$

2) There are 4 different expressions in Column A. Find an equivalent expression for each in Column B. There may be more than one match or no match.

Column A	
a)	$(d + 1)2$
b)	$(d + 1)^2$
c)	$(d + 1) - 2$
d)	$(d + 1)d + 1$

Column B	
A.	$d + 1 - 2$
B.	$2d + 2$
C.	$(d + 1)(d + 1)$
D.	$-2(d + 1)$
E.	$2(d + 1)$

3) Simplify:
   a) $m + 2m(m + y)$
   b) $(m + y)2m + m$
   c) $m - 2m(m + y)$
   d) $(m + 2)m - 5m$
   e) $(m + 2)(-m) - 5$

Worksheet 4.6

Answers

1) **Question and answers are grouped together for Q1**

Look at each pair of expressions and do the following:

- Say what is the same about each expression in the pair
- Simplify each expression
- Are the answers in the pair the same or different?
- Say why the answers are the same or different

a) $2(x + 3)$

b) $-2(x + 3)$

- the brackets have the same terms
- $2x + 6$ and $-2x - 6$
- The answers are different
- The signs of the monomials are different . In Q1a we multiply a positive 2 into the bracket but in Q1b we multiply a negative 2 into the bracket.

c) $(x + 3)(-2)$

d) $(x + 3) - 2$

- The binomial $(x + 3)$ is the same in both.
- $-2x - 6$ and $x + 1$
- The answers are different
- In Q1c, -2 is multiplied by $(x + 3)$. In Q1d, 2 is subtracted from $(x + 3)$

e) $-2(x + 3) - 2$

f) $-2(x + 3) + 2$

- -2 is multiplied by $(x + 3)$ in both.
- $-2x - 6 - 2 = -2x - 8$ and $-2x - 6 + 2 = -2x - 4$
- Answers are different
- In Q1e, 2 is subtracted from $-2(x + 3)$ while in Q1f, 2 is added to $-2(x + 3)$.

g) $(b + c) - 2b + b$

h) $(b + c)(-2b) + b$

- The binomial $(b + c)$ is the same and b is added to the answer in both.
- c and $-2b^2 - 2bc + b$
- Answers not the same
- In Q1g, $2b$ is subtracted from $(b + c)$ but in Q1h, $(b + c)$ is multiplied by$-2b$.

i) $(-d + e) - 2d(-d)$

j) $(-d + e)(-2d) - d$

- $(-d + e)$ is the same.
- $-d + e + 2d^2$ and $2d^2 - 2de - d$
- Answers not the same
- In Q1i, $2d$ is multiplied by – d and subtracted from $(-d + e)$ but in Q1j, $-2d$ is multiplied by $(-d + e)$ and d is subtracted from the answer.

<table>
<tr><th>Question</th><th>Answers</th></tr>
<tr><td>2) There are 4 different expressions in Column A. Find an equivalent expression for each in Column B. There may be more than one match or no match.
<table>
<tr><th colspan="2">Column A</th></tr>
<tr><td>a)</td><td>$(d + 1)2$</td></tr>
<tr><td>b)</td><td>$(d + 1)^2$</td></tr>
<tr><td>c)</td><td>$(d + 1) - 2$</td></tr>
<tr><td>d)</td><td>$(d + 1)d + 1$</td></tr>
</table>
<table>
<tr><th colspan="2">Column B</th></tr>
<tr><td>A.</td><td>$d + 1 - 2$</td></tr>
<tr><td>B.</td><td>$2d + 2$</td></tr>
<tr><td>C.</td><td>$(d + 1)(d + 1)$</td></tr>
<tr><td>D.</td><td>$-2(d + 1)$</td></tr>
<tr><td>E.</td><td>$2(d + 1)$</td></tr>
</table>
</td><td>2)
a) B and E
b) C
c) A
d) No match $d^2 + d + 1$</td></tr>
<tr><td>3) Simplify:
a) $m + 2m(m + y)$
b) $(m + y)2m + m$
c) $m - 2m(m + y)$
d) $(m + 2)m - 5m$
e) $(m + 2)(-m) - 5$</td><td>3)
a) $m + 2m^2 + 2my = 2m^2 + 2my + m$
b) $2m^2 + 2my + m$
c) $m - 2m^2 - 2my$
d) $m^2 + 2m - 5m = m^2 - 3m$
e) $-m^2 - 2m - 5m = -m^2 - 7m$</td></tr>
</table>

Worksheet 4.7

In this worksheet you will focus on: adding, subtracting and multiplying algebraic expressions which have 2 or more terms in brackets and 3 or more terms in the expressions.

Questions

1) There are 6 examples of algebraic expressions in the box below.

   - A. $3 - t(t + 3)$
   - B. $(t + 3)3 - t$
   - C. $1 + t + (t + 1)$
   - D. $(t + 1) + t + 1$
   - E. $(t + 2) - 2t$
   - F. $(t + 2)(-2t)$

   Look at the examples carefully and answer these questions:

   a) In which examples must you multiply t into the bracket?
   b) Simplify each example.
   c) You should have got the same answer for C and D. Why does this happen?
   d) Make one change to D so that the answer is 2.

2) Look at the 3 examples of algebraic expressions in the box below. Read all the questions (a-d) before you begin.

   - A. $4(2p + 3p)$
   - B. $4p(p + 2p + 2)$
   - C. $4p(3 + 2p + 1)$

   a) Re-write A, B and C by adding the like terms in the brackets.
   b) Now simplify your new expressions for A, B and C.
   c) Now go back to the original expressions for A, B and C in the box. Simplify by applying the distributive law.
   d) Check that you get the same answers in Q2b and Q2c.

3) Look at the 8 examples of algebraic expressions in the box.

   - A. $2a + (3 + a)$
   - B. $2 + a + (3 + a)$
   - C. $2 + a(3 + a)$
   - D. $a + a(3 + a)$
   - E. $a + a + (3 + a)$
   - F. $2 + 2(3 + a)$
   - G. $3 + 2 + (3 + a)$

   a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket?
   b) In which examples are the brackets unnecessary?
   c) In which examples must you apply the distributive law?
   d) Simplify each example. Try to go from the question straight to the answer.

4) Simplify:

   a) $m - 2 + m - 2$
   b) $x + y - 2(x + y)$
   c) $3r + (4 - r)2$
   d) $3r + 2 - (4 - r)$
   e) $(2x + y) - 2x + y$
   f) $-2(x + y) - (x + y)$

Worksheet 4.7

Answers

Questions	Answers
1) There are 6 examples of algebraic expressions in the box below. A. $3-t(t+3)$ B. $(t+3)3-t$ C. $1+t+(t+1)$ D. $(t+1)+t+1$ E. $(t+2)-2t$ F. $(t+2)(-2t)$ Look at the examples carefully and answer these questions: a) In which examples must you multiply t into the bracket? b) Simplify each example. c) You should have got the same answer for C and D. Why does this happen? d) Make one change to D so that the answer is 2.	1) a) A and F b) A. $3-t^2-3t$ B. $2t+9$ C. $2t+2$ D. $2t+2$ E. $-t+2$ F. $-2t^2-4t$ c) Because of the commutative law: $a+b=b+a$ d) $(t+1)-t+1$
2) Look at the 3 examples of algebraic expressions in the box below. Read all the questions (a-d) before you begin. A. $4(2p+3p)$ B. $4p(p+2p+2)$ C. $4p(3+2p+1)$ a) Re-write A, B and C by adding the like terms in the brackets. b) Now simplify your new expressions for A, B and C. c) Now go back to the original expressions for A, B and C in the box. Simplify by applying the distributive law. d) Check that you get the same answers in Q2b and Q2c.	2) a) A. $4(5p)$ B. $4p(3p+2)$ C. $4p(2p+4)$ b) A) $20p$ B) $12p^2+8p$ C) $8p^2+16p$ c) A. $20p$ B. $12p^2+8p$ C. $12p+8p^2$ d) Yes, they are the same.
3) Look at the 8 examples of algebraic expressions in the box. A. $2a+(3+a)$ B. $2+a+(3+a)$ C. $2+a(3+a)$ D. $a+a(3+a)$ E. $a+a+(3+a)$ F. $2+2(3+a)$ G. $3+2+(3+a)$ a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket? b) In which examples are the brackets unnecessary? c) In which examples must you apply the distributive law? d) Simplify each example. Try to go from the question straight to the answer.	3) a) F and H b) B,C, F and H c) A, D,E and G d) A. $6a+2a^2$ B. $3a+3$ C. $5+2a$ D. $2+3a+a^2$ E. $4a+a^2$ F. $3a+3$ G. $8+2a$ H. $8+a$
4) Simplify: a) $m-2+m-2$ b) $x+y-2(x+y)$ c) $3r+(4-r)2$ d) $3r+2-(4-r)$ e) $(2x+y)-2x+y$ f) $-2(x+y)-(x+y)$	4) a) $2m-4$ b) $-x-y$ c) $r+8$ d) $4r-2$ e) $2y$ f) $-3x-3y$

Worksheet 4.8

In this worksheet you will focus on: adding, subtracting and multiplying algebraic expressions which have 2 or more terms in brackets and 3 or more terms in the expressions.

Questions

1) There are 6 examples of algebraic expressions in the box below.

A. $5 - a(a + 5)$
B. $(a\ +\ 5)5 - a$
C. $3 + a + (a\ +\ 3)$
D. $(a\ +\ 3) + a + 3$
E. $(a + 4) - 4a$
F. $(a + 4)(-4a)$

Look at the examples carefully and answer these questions:

a) In which examples must you multiply a into the bracket?
b) Simplify each example.
c) You should have got the same answer for C and D. Why does this happen?
d) Make one change to D so that the answer is 2a.

2) Look at the 3 examples of algebraic expressions in the box below. Read all the questions (a-d) before you begin.

A. $5(p +\ 3p)$
B. $5p(p\ + 3p +\ 2)$
C. $5p(3\ + p +\ 1)$

a) Re-write A, B and C by adding the like terms in the brackets.
b) Now simplify your new expressions for A, B and C.
c) Now go back to the original expressions for A, B and C in the box. Simplify by applying the distributive law.
d) Check that you get the same answers in Q2b and Q2c.

3) Look at the 8 examples of algebraic expressions in the box.

A. $2x(4 + x)$
B. $2x + (4 + x)$
C. $2 + x + (1 - x)$
D. $2 + x(1 - x)$
E. $x - x(4 + x)$
F. $x - x + (4 + x)$
G. $1 + (3 + x)2$
H. $1 + 2 - 3(1 + x)$

a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket?
b) In which examples must you apply the distributive law?
c) In which examples are the brackets unnecessary?
d) Simplify each example.

4) Simplify:

a) $2b + 3(4 - b) + b$
a) $2b + 3 - (4 - b) + 5b$
c) $2b - 3 + b(4 - b) + 5$
d) $(x\ + y) - 2x + x$
e) $-2x(x\ + y) - 2x - x$
f) $(x\ + y +\ 3) - 2x - 3$

Worksheet 4.8

Answers

Questions	Answers
1) There are 6 examples of algebraic expressions in the box below. A. $5-a(a+5)$ B. $(a\ +\ 5)5-a$ C. $3+a+(a\ +\ 3)$ D. $(a\ +\ 3)+a+3$ E. $(a+4)-4a$ F. $(a+4)(-4a)$ Look at the examples carefully and answer these questions: a) In which examples must you multiply a into the bracket? b) Simplify each example. c) You should have got the same answer for C and D. Why does this happen? d) Make one change to D so that the answer is $2a$.	1) a) A and F b) A. $5-a^2-5a$ B. $4a+25$ C. $6+2a$ D. $2a+6$ E. $-3a+4$ F. $-4a^2-16a$ c) Addition is commutative d) $(a+4)+\boldsymbol{a}-\mathbf{4}=2a$
2) Look at the 3 examples of algebraic expressions in the box below. Read all the questions (a-d) before you begin. A. $5(p+\ 3p)$ B. $5p(p\ +3p+\ 2)$ C. $5p(3\ +p+\ 1)$ a) Re-write A, B and C by adding the like terms in the brackets. b) Now simplify your new expressions for A, B and C. c) Now go back to the original expressions for A, B and C in the box. Simplify by applying the distributive law. d) Check that you get the same answers in Q2b and Q2c.	2) a) A. $5(4p)$ B. $5p(4p+2)$ C. $5p(4+p)$ b) A. $20p$ B. $20p^2+10p$ C. $20p+5p^2$ c) A. $20p$ B. $20p^2+10p$ C. $20p+5p^2$ d) Yes, they are the same
3) Look at the 8 examples of algebraic expressions in the box. A. $2x(4+x)$ B. $2x+(4+x)$ C. $2+x+(1-x)$ D. $2+x(1-x)$ E. $x-x(4+x)$ F. $x-x+(4+x)$ G. $1+(3+x)2$ I. $1+2-3(1+x)$ a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket? b) In which examples must you apply the distributive law? c) In which examples are the brackets unnecessary? d) Simplify each example.	3) a) C,F and H b) A, D,E,G and H c) B,C and F d) A. $8x+2x^2$ B. $3x+4$ C. 3 D. $2+x-x^2$ E. $-3x-x^2$ F. $4+x$ G. $7+2x$ H. $-3x$
4) Simplify: a) $2b+3(4-b)+b$ b) $2b+3-(4-b)+5b$ c) $2b-3+b(4-b)+5$ d) $(x\ +y)-2x+x$ e) $-2x(x\ +y)-2x-x$ f) $(x\ +y+\ 3)-2x-3$	4) a) 12 b) $8b-1$ c) $-b^2+6b+2$ d) y e) $-2x^2-2xy-3x$ f) $-x+y$

Worksheet 4.9

In this worksheet you will focus on: adding, subtracting and multiplying algebraic expressions which have 2 or more terms in brackets and 3 or more terms in the expressions.

Questions

1) There are 6 examples of algebraic expressions in the box below.

A. $(p + 3) - 5 - p$
B. $5 - p - (p + 3)$
C. $5p(p + 3)$
D. $(p + 3)5 - p$
E. $(p + 3) - 5p$
F. $(p + 3)(-5p)$

Look at the examples carefully and answers these questions:

a) In which examples must you multiply p into the bracket?
b) In which examples must you multiply 5 (or -5) into the bracket?
c) Simplify each example.

2) Look at the 5 examples of algebraic expressions in the box below.

A. $2m(6 + 2m + 1)$
B. $2m(m + 6m + k)$
C. $2(k + m + 1)$
D. $2(6 + 2m + gm)$
E. $2m(6 + 2m + k)$

a) In which examples can you simplify terms <u>inside</u> the bracket before you apply the distributive law?
b) Simplify by applying the distributive law.

3) Look at the 8 examples of algebraic expressions in the box.

A. $2t(4 + t)$
B. $2t + (4 + t)$
C. $2 + t - (4 + t)$
D. $2 + t(4 + t)$
E. $t - t(4 + t)$
F. $t + t + (3 - t)$
G. $2 + 2(3 + t)$
H. $10 + 3 - (3 - t)$

a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket?
b) In which examples must you apply the distributive law?
c) In which examples are the brackets unnecessary?
d) Simplify each example. Try to go from the question straight to the answer.

4) Simplify:

a) $4n + 3(5 - n) + n$
b) $4n + 3 - (5 - n) + n$
c) $4n - 3 + n(5 - n) + 5$
d) $(c + d) - 4c + c$
e) $(c + d + 3) - 4c - 3c(c + d + 3) - 3$
f) $-4c(c + d) - 4c - (c + d)(-4c) - c - 2$

Worksheet 4.9

Answers

Questions	Answers
1) There are 6 examples of algebraic expressions in the box below. A. $(p + 3) - 5 - p$ B. $5 - p - (p + 3)$ C. $5p(p + 3)$ D. $(p + 3)5 - p$ E. $(p + 3) - 5p$ F. $(p + 3)(-5p)$ Look at the examples carefully and answers these questions: a) In which examples must you multiply p into the bracket? b) In which examples must you multiply 5 (or -5) into the bracket? c) Simplify each example.	1) a) C and F b) C, D and F c) A. -2 B. $2 - 2p$ C. $5p^2 + 15p$ D. $4p + 15$ E. $-4p + 3$ F. $-5p^2 - 15p$
2) Look at the 5 examples of algebraic expressions in the box below. A. $2m(6 + 2m + 1)$ B. $2m(m + 6m + k)$ C. $2(k + m + 1)$ D. $2(6 + 2m - 6m)$ E. $2m(6 + 2m + k)$ a) In which examples can you simplify terms <u>inside</u> the bracket before you apply the distributive law? b) Simplify by applying the distributive law.	2) a) A, B and D b) A. $14m + 4m^2$ B. $14m^2 + 2mk$ C. $2k + 2m + 2$ D. $12 - 8m$ E. $12m + 4m^2 + 2mk$ $= 4m^2 + 2mk + 12m$
3) Look at the 8 examples of algebraic expressions in the box. A. $2t(4 + t)$ B. $2t + (4 + t)$ C. $2 + t - (4 + t)$ D. $2 + t(4 + t)$ E. $t - t(4 + t)$ F. $t + t + (3 - t)$ G. $2 + 2(3 + t)$ H. $10 + 3 - (3 - t)$ a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket? b) In which examples must you apply the distributive law? c) In which examples are the brackets unnecessary? d) Simplify each example. Try to go from the question straight to the answer.	3) a) F and H b) A, D, E and G c) B and F d) A) $8t + 2t^2$ B) $3t + 4$ C) -2 D) $2 + 4t + t^2$ E) $-3t - t^2$ F) $t + 3$ G) $8 + 2t$ H) $10 + t$
4) Simplify: a) $4n + 3(5 - n) + n$ b) $4n + 3 - (5 - n) + n$ c) $4n - 3 + n(5 - n) + 5$ d) $(c + d) - 4c + c$ e) $(c + d + 3) - 4c - 3c(c + d + 3) - 3$ f) $-4c(c + d) - 4c - (c + d)(-4c) - c - 2$	4) a) $15 + 2n$ b) $4n - 2$ c) $-n^2 + 9n + 8$ d) $-2c + d$ e) $-12c + d - 3c^2 - 3cd$ $= -3c^2 - 3cd - 12c + d$ f) $-5c - 2$

Worksheet 4.10

In this worksheet you will focus on: adding, subtracting and multiplying algebraic expressions which have 2 or more terms in brackets and 3 or more terms in the expressions.

Questions

1) There are 6 examples of algebraic expressions in the box below.

A. $4 - j - (j + 2)$
B. $(j + 2) - 4 - j$
C. $4 - j(j + 2)$
D. $(j + 2)4 - j$
E. $(j + 2) - 4j$
F. $(j + 2)(-4j)$

Look at the examples carefully and answers these questions:

a) In which examples must you multiply j into the bracket?
b) In which examples must you multiply 4 (or -4) into the bracket?
c) Simplify each example.

2) Look at the 5 examples of algebraic expressions in the box below.

A. $2g(g + 2g + h)$
B. $2g(4 + 2g + 3)$
C. $2(4 + 2g + 3g)$
D. $2(h + 3g + 3)$
E. $2g(4 + 3g + h)$

a) In which examples can you simplify terms <u>inside</u> the bracket before you apply the distributive law?
b) Simplify by applying the distributive law.

3) Look at the 8 examples of algebraic expressions in the box:

A. $3t(4 + t) + 5$
B. $3t + (4 + t) - 5$
C. $3 + t - (4 + t)$
D. $-3 + t(4 + t) - t$
E. $-t - t(4 + t)$
F. $t + t + (2 - t) + 5$
G. $-3 + 3(2 + t) + t$
H. $10 + 2 - (2 - t)$

a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket?
b) In which examples must you apply the distributive law?
c) In which examples are the brackets unnecessary?
d) Simplify each example. Try to go from the question straight to the answer.

4) Simplify:

a) $2u + 3(4 - u) + u$
b) $2u + 3 - (4 - u) + 5u$
c) $2u - 3 + u(4 - u) + 5$
d) $(a + b) - 2a + a$
e) $(a + b + 3) - 2a - 3a(a + b + 3) - 3$
f) $-2a(a + b) - 2a - (a + b)(-2a) - a - 2$

Worksheet 4.10

Answers

Questions	Answers
1) There are 6 examples of algebraic expressions in the box below: A. $4 - j - (j + 2)$ B. $(j + 2) - 4 - j$ C. $4 - j(j + 2)$ D. $(j + 2)4 - j$ E. $(j + 2) - 4j$ F. $(j + 2)(-4j)$ Look at the examples carefully and answers these questions: d) In which examples must you multiply j into the bracket? e) In which examples must you multiply 4 (or -4) into the bracket? f) Simplify each example.	1) a) C and F b) D and F c) A. $-2j + 2$ B. -2 C. $4 - j^2 - 2j = -j^2 - 2j + 4$ D. $3j + 8$ E. $-3j + 2$ F. $-4j^2 - 8j$
2) Look at the 5 examples of algebraic expressions in the box below: A. $2g(g + 2g + h)$ B. $2g(4 + 2g + 3)$ C. $2(4 + 2g + 3g)$ D. $2(h + 3g + 3)$ E. $2g(4 + 3g + h)$ a) In which examples can you simplify terms <u>inside</u> the bracket before you apply the distributive law? b) Simplify by applying the distributive law.	2) a) A, B and C b) A. $6g^2 + 2gh$ B. $14g + 4g^2$ C. $8 + 10g$ D. $2h + 6g + 6$ $= 6g + 2h + 6$ E. $8g + 6g^2 + 2gh$ $= 6g^2 + 2gh + 8g$
3) Look at the 8 examples of algebraic expressions in the box: A. $3t(4 + t) + 5$ B. $3t + (4 + t) - 5$ C. $3 + t - (4 + t)$ D. $-3 + t(4 + t) - t$ E. $-t - t(4 + t)$ F. $t + t + (2 - t) + 5$ G. $-3 + 3(2 + t) + t$ H. $10 + 2 - (2 - t)$ a) In which examples can you simplify terms <u>outside</u> the bracket before you deal with the bracket? b) In which examples must you apply the distributive law? c) In which examples are the brackets unnecessary? d) Simplify each example. Try to go from the question straight to the answer.	3) a) F and H b) A, D,E and G c) B and F d) A. $12t + 3t^2 + 5 = 3t^2 + 12t + 5$ B. $4t - 1$ C. -1 D. $-3 + 3t + t^2$ E. $-5t - t^2$ F. $t + 7$ G. $3 + 4t$ H. $10 + t$
4) Simplify: a) $2u + 3(4 - u) + u$ b) $2u + 3 - (4 - u) + 5u$ c) $2u - 3 + u(4 - u) + 5$ d) $(a + b) - 2a + a$ e) $(a + b + 3) - 2a - 3a(a + b + 3) - 3$ f) $-2a(a + b) - 2a - (a + b)(-2a) - a - 2$	4) a) 12 b) $8u - 1$ c) $-u^2 + 6u + 2$ d) b e) $-3a^2 - 3ab - 10a + b$ f) $-3a - 2$