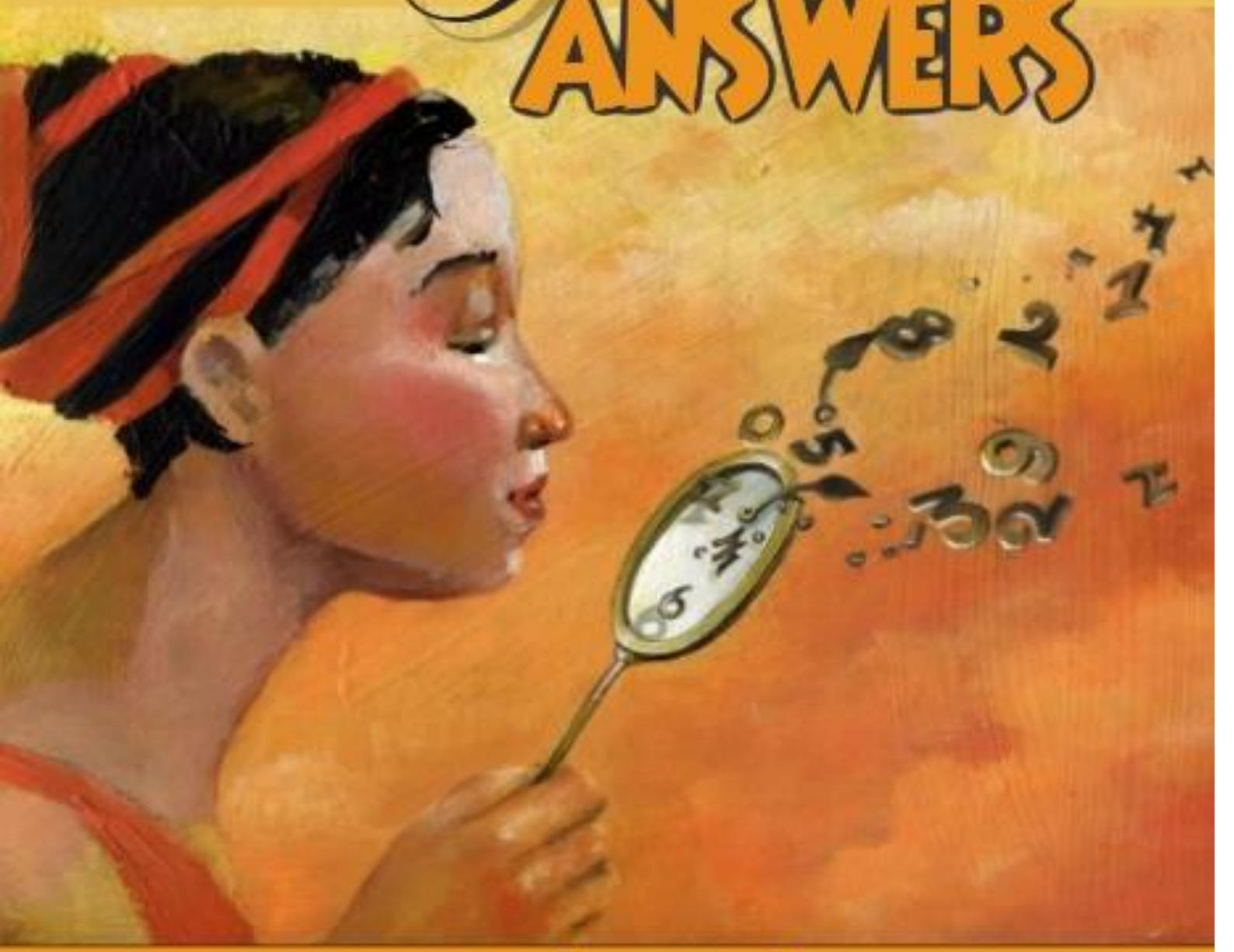
A level mathematics Assignment 3 Algebra 2021 answers

P1 Mathematics (University of Oxford)

Level 4

MATHS ASSIGNMENT 3

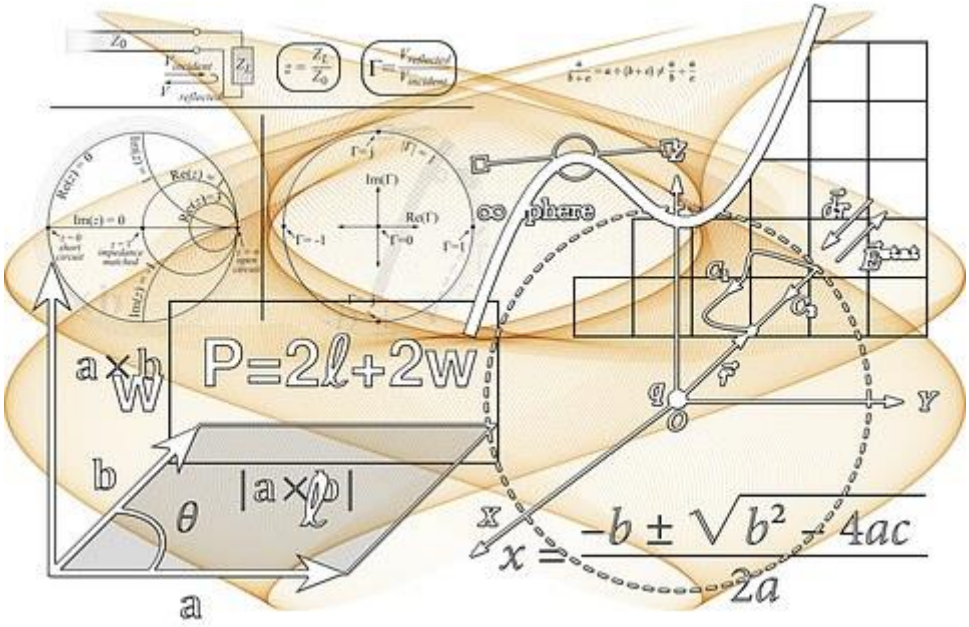
Algebra ANSWERS



MATHEMATICS

QQI Level 4 (4N1987)

Assignment 3 - ALGEBRA



INSTRUCTIONS TO THE CANDIDATES

1. Enter your name below.
2. Complete the questions in the space provided.
3. Extra space is available at the back of this document if required.
4. Use of a scientific calculator is allowed.
5. Formulae are provided separately.
6. Include units in your answers, where applicable.
7. Show all working out.
8. Answers must be written correct to 2 decimal places.

Name: _____

Date: _____

ASSESSMENT BRIEF 3

Component title:	Mathematics
Component code:	4N1987
Assessment technique:	Assignment
Assessment title:	Algebra
Assessment number:	3
Weighting:	20%

Guidelines:

You will be expected to:

1. Discuss the presence of variables in a range of real life situations
2. Solve algebraic equations including linear equations of one variable, simultaneous linear equations of two unknowns, and linear inequalities of one variable
3. Solve quadratic equations using factors and the quadratic formula
4. Construct algebraic expressions and formulae for real life situations using the correct terminology and including rearrangement of formulae.

Assessment criteria:

In completing your assignment, you must do the following:

- adhere to mathematical precedence rules
- use appropriate formula as required
- correctly apply mathematical concepts to real-life situations
- identify at least five variables
- identify at least five algebraic equations
- solve at least five simple formulas
- derive at least three formulas
- change the subject of at least three formulas
- solve at least five linear equations
- use a calculator correctly
- round decimals as appropriate
- correctly substitute formulae as required

- obtain an accurate answer
- use terminology correctly
- use mathematical symbols and letters correctly
- set out work in a format demonstrating a logical progression of thought
- present and lay out work clearly

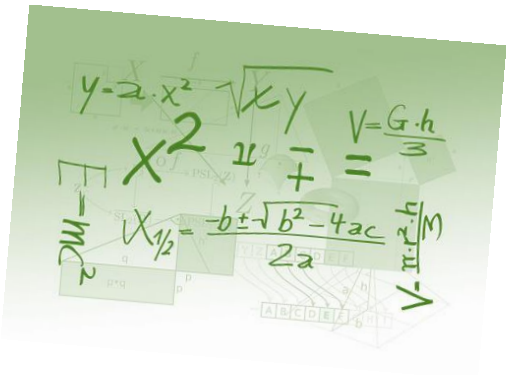
Your assignment will be assessed in the following way:

- Variables in everyday life – 20 marks
- Solving algebraic equations – 20 marks
- Solving quadratic equations – 20 marks
- Constructing algebraic expressions / formulae in real-life situations – 20 marks

TOTAL: 80 marks ÷ 4 = 20 marks

Marks will be deducted from the total for each question on the assignment, for example, for:

- Incorrect/illogical layout
- Omitting units of measurement in final answers
- Answers not correct to 2 decimal places, where applicable
- More than 2 attempts
- Blunders - mathematical errors/omissions
- Slips - numerical errors
- Misreadings
- Marks may be deducted for late submission.



Note: Discussions may be recorded.

There may be questions on the assignment which do not carry marks but will assist you with examination preparation. It is in your best interests to complete these.

Date brief was issued: _____ Submission date: _____

I confirm that this is my original work.

Signed: _____ Date: _____

A. Variables

1. Identify the variables in each of the following situations:

You may start to cook dinner at 5.30 p.m. every day. If this is a 'constant', what might the variables be?
Examples of variables in this situation:

- The time it takes you to prepare the meal
- The cost of the meal
- The ingredients you use
- The cooking time, …etc!

a) The cost of a mobile phone bill

Cost, number of calls, number of texts, data usage, etc.

b) The amount of petrol used in one month

Amount of petrol used, cost of petrol, distances travelled, etc.

c) The amount of flour you use for pancakes

Type of pancakes, number of pancakes, etc.

d) Think about a local shopping centre. Make a list of all the elements in this setting. Some examples are: the car park, the number of shops, the elevators, etc. Decide which are variables (with quantities that vary) and which are constants (with quantities that stay the same). Will any of these be both? Talk about your answers.

Number of visitors, opening hours, area, parking costs, number of shops visited, amount money spent, number of items bought, etc.

1 MARK

2. Use letters and other algebraic symbols to translate the following verbal statements:

Examples:

▪ nine increased by a number x	9 + x
▪ fourteen decreased by a number p	14 - p
▪ seven less than a number t	t – 7
▪ five more than twice a number	2n + 5
▪ the product of a number and 6	6n
▪ the product of 9 and a number n	9n
▪ thirty-two divided by a number y	32 ÷ y or $\frac{32}{y}$

a) Eight times a number 8x

b) Three times a number plus twelve 3x + 12

c) The product of two different numbers xy

d) Five times the sum of two different numbers

5 (x + y)

e) The sum of three different numbers x + y + z

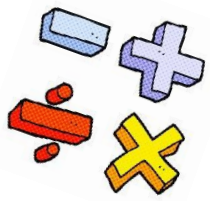
f) Four times a number plus six times another number

4x + 6y

g) The difference between a number and two times another number

x – 2y

h) A quarter of a number x/4



i) Nine less than the total of a number and two

(x + 2) - 9

j) The length of a field is 30 metres more than its width. Express the length of the field in terms of its width w.

W = L - 30

k) Seven divided by twice a number 7/2x

1 MARK

3. Write the following expressions:

a) Bob has b euro. Ciaran has 1000 fewer euros than Ben.

c = b - 1000

b) Richard caught f fish two weeks ago and 23 fish last week. How many fish has Richard caught these last two weeks combined?

f + 23

c) Jenny earns €63 a day working part time at a supermarket. Write an algebraic expression to represent the amount of money she will earn in d days. 63d

d) Martin is missing half of his socks. If s represents the number of socks, write an expression to show how many socks Martin is missing.

s/2

e) Nathan brings muffins to class and gives them to the 9 students in his class, who share them equally. If m represents the number of muffins Nathan brings to class, write an expression to show how many muffins each of the students receive.

m/9

f) Jason can type w words per minute. Luke can type 4 times as many words as Jason. Write an expression that represents the rate at which Luke can type. 4w

g) The amount I took to place bets was d. I lost €5 and then I doubled my money.

2(d-5)

2 MARKS

B. Simplifying expressions

1. Simplify the following expressions:

Examples:

- 5y - 4y = 1y
- 8 - 9d - 3 - 6d = -15d +5
- 8(-2y - 6) = -16y -48
- -7 + 8b - 2b + 4 = 6b -3
- 10 - 11g + 18 = -11g + 28
- 3m + n - m + 4n - 2m = 5n
- $3(x + y) + 2(3x – y) = 9x + y$
- $4(8x – 4 – 3x^2) – 4x = –12x^2 + 28x – 16$

-6t(-7t + 9)

$42t^2 - 54$

-(-5a + 9)

$5a - 9$

(-4 - 5z)4

$-16 - 20z$

(-p + 1)(-6)

$6p - 6$

(-3t + 7)(-6)

$18t - 42$

-5(9 - 6b)

$-45 + 30b$

v(8v - 8)

$8v^2 – 8v$

-5q(-3 - 5q)

$15q + 25q^2$

2y(-7y - 5)

$14y^2 – 10y$

7(-2 - 8j)

$-14 -56j$

PRACTICE

-6(9j - 6)

-54j + 36

-6x(-2 - 7x)

$12x + 42x^2$

6(5 - w)

30 – 6w

2(9f + 3)

18f + 6

5(-3 + 9v)

-15 + 45v

-8(-a - 8)

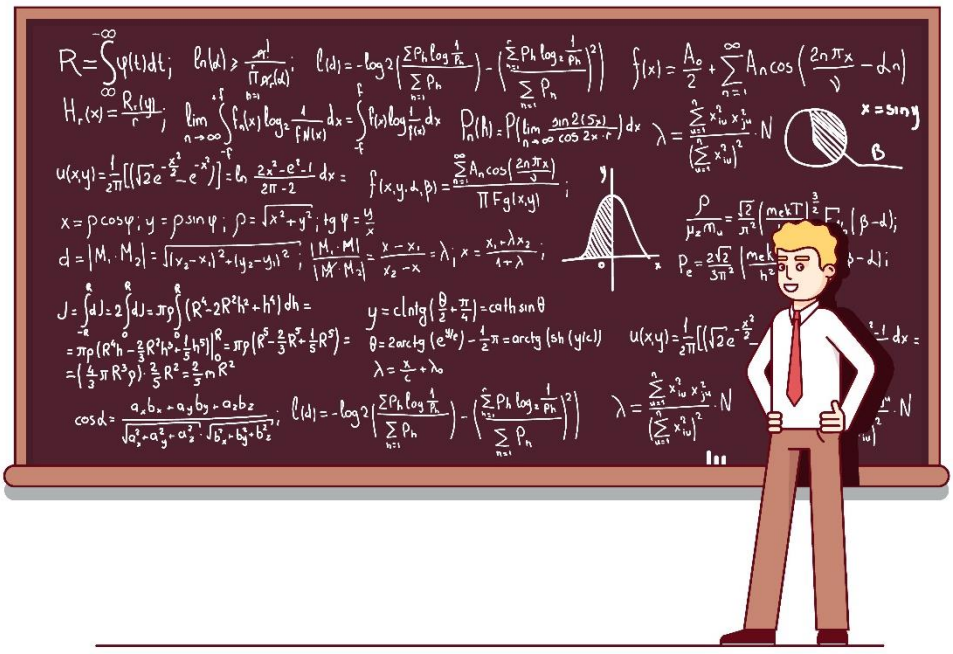
8a + 64

-3(8p + 5)

-24p - 15

3b(-9 - 7b)

$-27b - 21b^2$



PRACTICE

2. Simplify the following expressions:

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

$a^2 + 2a + 1$

$6+1-1+b$

$6 + b$

$1+y-3-cy$

$y - cy - 2$

$2u+uy+uy+u$

$3u + 2uy$

$-1-3av+6v^2-4v^2$

$2v^2 - 3av - 1$

$-5z-1+cz+6$

$-5z + cz + 5$

$6-4+z-z^2$

$-2 + z - z^2$

$-2+2x-1+1$

$2x - 2$

$6+3b^2-b+5$

$3b^2 - b + 11$

$1+c^2-b^2+3$

$c^2 - b^2 + 4$

PRACTICE

3. Simplify the following expressions:

Example:

$$\frac{a^2b}{ab^2}$$

When simplifying algebraic fractions, you may notice that there is more than one common factor:

$$\frac{\mathbf{a^2b}}{\mathbf{ab^2}} = \frac{\mathbf{a \times a \times b}}{\mathbf{a \times b \times b}}$$

Since **a** and **b** are both factors, we can cancel this fraction by dividing by both a and b from the top and bottom.

$$\frac{a^2b}{ab^2} = \frac{a \times a \times b}{a \times b \times b} = \frac{1 \times a \times 1}{1 \times 1 \times b} = \frac{a}{b}$$

$$\frac{x^2 + 4x}{x^2 - 16}$$

$$\frac{3(a-b)}{9} + \frac{4b}{9}$$

$\frac{x}{x-4}$ $\frac{3a+b}{9}$

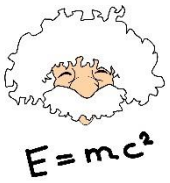
$$\frac{(x+2)}{(x+5)(x+2)}$$

$$\frac{a+b}{2} - \frac{2}{5}$$

$\frac{1}{(x+5)}$ $\frac{a+5b}{10}$

PRACTICE

4. To revise, simplify the following expressions:



a) $3x + 2y - x + 3y$

$= 3b^2 - b + 11$

b) $4x^2 - 3 - x^2 - 4$

$= 3x^2 - 7$

c) $2(x + 1) + 3(x + 3)$

$2x + 2 + 3x + 9$

$= 5x + 11$

d) $2(5x - 1) - 3(2x - 8)$

$10x - 2 - 6x + 24$

$= 4x + 22$

e) $5(x^2 + 4x) + 2x^2 - 3x - 4$

$5x^2 + 20x + 2x^2 - 3x - 4$

$= 7x^2 + 17x - 4$

PRACTICE

C. Evaluating expressions

1. Evaluate the following expressions:

Examples:
Replace the letter/s with the given values!

- q^2, when q = –10, Answer = 100
- $(10q - 4)^5$, when q = 7, Answer = 1252332576
- $\frac{6q-g}{4}$6q – g, when q = –4 and g = 1, Answer = -6 ¼

a) w + (–7), when w = –1

-8

b) –5d + (–6)u – 3, when d = 2 and u = 7

-55

c) b – n – 8, when b = –3 and n = 5

-16

d) d(–7 – s), when d = –5 and s = –2

25

e) p – c, when p = –3 and c = –8

5

f) $\frac{7p+5}{-5}$, when p = –3

3 1/5

g) $\frac{s+(-7)}{-1}$, when s = –3

10

I MARK

D. Solving for x

Solve the following equations:

Examples:
Solve for x: -3 + 2x = 11
2x = 11 + 3 (change the sign when you move it over)
2x = 14
x = 14/2 (change the sign from X to ÷)
x = 7

a) 5x + 1 = 3x + 11

2x = 10, x = 5

b) 2x + 6 = 4x – 6

12 = 2x, x = 6

c) 3(2x+ 1) = 2x + 11

6x + 3 = 2x + 11, 4x = 8, x = 2

d) 3(2x – 6) = 2(2x + 1)

6x – 18 = 4x + 2, 2x = 20, x = 10

e) 2(5x + 2) – 2x = 3(2x + 3) + 7

10x + 4 – 2x = 6x + 9 + 7, 8x + 4 = 6x + 16,
2x = 12, x = 6

PRACTICE

E. Linear equations

1. Solve the following linear equations:

a) 3x + 15 = x + 25

$2x = 10, x = 5$

b) 2x + 3 = 6 –(2x-3)

$2x + 3 = 6 – 2x + 3, 2x + 3 = -2x + 9$

$4x = 6, x = 1.5$

c) 4x + 3 = 15

$4x = 12, x = 3$

d) x + 5 = 9

$x = 4$

e) 4x + 10 = 2

$4x = -8, x = -2$

f) 9 + 5x = 3x + 13

$2x = 4, x = 2$

Another example:

$$3x + 15 = x + 25$$
$$3x - x = 25 - 15$$
$$2x = 10$$
$$x = 5$$

1 MARK

g) $12 - x = 7$

$x = 5$

h) $5 - 3x = -4$

$9 = 3x, x = 3$

i) $4 - 3x = 8 + x$

$-4 = 4x, x = -1$

j) $5x = 3$

$x = 3/5$

k) $2 + 14x = 30$

$14x = 28, x = 2$

l) $5 + 3(x-1) = 5x - 6$

$5 + 3x - 3 = 5x - 6$

$3x + 2 = 5x - 6$

$8 = 2x, x = 4$

1 MARK

m)8(x-3) – (6-2x) = 2(x+2) - 5(5-x)

$8x - 24 - 6 + 2x = 2x + 4 - 25 + 5x$

$10x - 30 = 7x - 21$

$3x = 9, x = 3$

n) $\frac{3}{4}x + \frac{5}{6} = 5x - \frac{125}{3}$

$x = 10$

o) $\frac{2x}{x-3} + 3 = \frac{6}{x-3}$ $(x \neq 3)$

This can be solved by having x = 3, but if we check by substituting x for 3, it would mean dividing by 0, and also, it states that $x \neq 3$, so there is no solution!

p) $\frac{m-2}{3} + 1 = \frac{2m}{7}$

$m = -7$

1 MARK

q) $\frac{2}{x+2} = \frac{-x}{x^2+5x+6}$

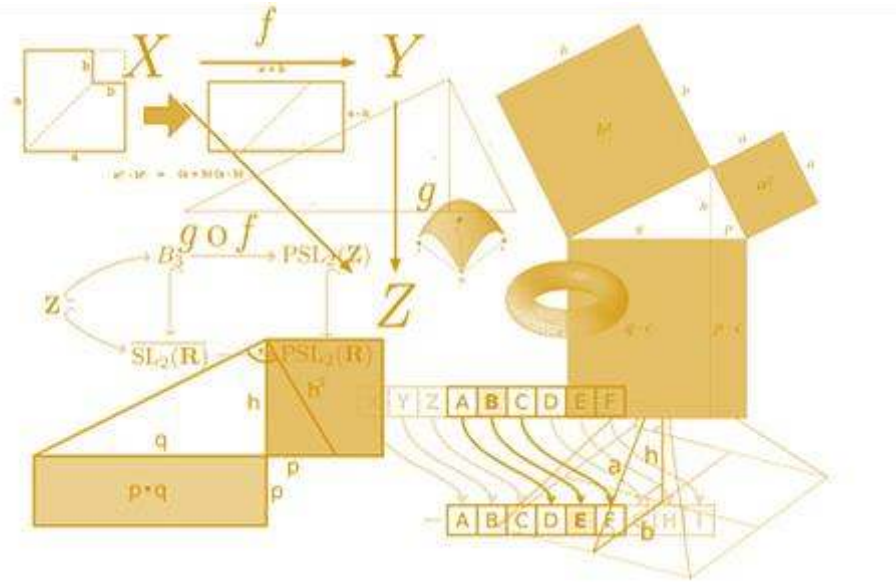
The LCD is (x + 2) (x + 3) and we will need to avoid x = -2 and x = -3 so we don't get division by zero, working it out we get x = -2. Seeing as this is a number to avoid in this instance, the equation has NO solution

r) $\frac{2z}{z+3} = \frac{3}{z-10} + 2$

$z = \frac{17}{3}$

Dear Algebra,

Please stop asking us to find your *x*. She's never coming back and don't ask *y*!



I MARK

F. Everyday thinking skills....

1. Write an equation for each of the following and then solve. Let ***x*** equal the unknown.

a) When 9 is added to a certain number, the result is 42. Find the number.

x = 33

b) When 2 is taken from 4 times a certain number, the answer is 18. Find the number.

x = 5

c) When 5 is added to a certain number and the result is multiplied by 3, the answer is 33. Find the number.

x = 6

d) When a number is increased by 4 and the result is doubled, the answer is 22. Find the number.

x = 7

2 MARKS

e) When 6 is taken from five times a certain number, the answer is 14. Find the number.

$5x - 6 = 14$, $5x = 20$, $x = 4$

f) Twice a number, decreased by twenty-nine, is seven.

$2x - 29 = 7$

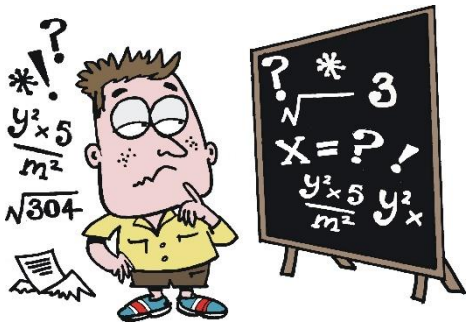
g) James is 7 years older than Elaine. If twice the sum of their ages is 66, find Elaine's age.

$2(x + x + 7) = 66$

$2x + 2x + 14 = 66$, $4x = 52$, $x = 13$, Elaine is 13

h) On an algebra test, the highest mark was 42 points higher than the lowest mark. The sum of the two marks was 138. Find the lowest mark.

$x = 48$



2 MARKS

i) Susan was posting gifts to her family. She weighed three envelopes before posting them.

Envelope A Envelope B Envelope C

- Envelope A weighed x grams.
- Envelope B was 50 grams lighter than Envelope A.
- Envelope C was three times as heavy as Envelope A.

Write in terms of x

the weight of Envelope B B = x - 50

the weight of Envelope C C = 3x

If the total weight of the three envelopes was 840 grams, write an equation in x and solve it to find the weight of Envelope A.

x + 3x + x – 50

5x – 50 = 840

5x = 890

x = 178

Envelope A is 178 grams

2 MARKS

G. Algebra for healthy living

1. Write down an equation in x to represent the following information:

a) I am walking every evening to keep fit. The distance around a lake is 650m. How far would I walk if I went around x times?

650x

b) How many metres in 4 ¾ times around?

(650)(4.75)
= 3097.5 metres

1 MARK

2. Write down an equation in y to represent the following information:

a) The number of fruit juices I drink every week day is y. How much does it cost me per week if each juice costs €2.10?

2.10y

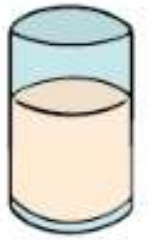
b) What is the cost per week if I drink 3 juices every week day?

(2.10)(3)
= €6.30

3. Write down an equation in m to represent the following information:

a) I have started drinking skimmed milk and it costs €1.65 per litre. How much will it cost per week: If m litres are used every day?

(7m)(1.65)



b) If 4 litres are used every day?

(7x4)(1.65)
= €46.20

2 MARKS

4. Write down an equation in *n* to represent the following information:

a) I have started making my own wholemeal bread, and I source the flour from a local shop. The shop sells ***n*** kilograms of wholemeal flour per day. How much would be used in 6 weeks?

(6x7)n = 42n

b) If 2.5kg was used per day, how much would be used in 6 weeks?

(42)(2.5) = 105 kg

1 MARK

Formula for simple interest:
$I = Prt$
(I = interest; P = principal; r = rate; t = time)

5. Work out the following:

a) I want to start saving to buy some gym equipment. I invest money at simple interest. How much interest is gained if €P is invested for t years at an interest rate of r% per annum?

$I = prt$

b) How much interest is gained if €520 is invested for 2 years at 5.5% p.a. simple?

$I = (520)(0.055)(2)$
$= €57.20$

1 MARK

H. Algebra around the house

Example:
My vegetable garden is rectangular in shape. It has a length of 8 metres and a width of 3 metres.
Find the perimeter.
P = 2 (L+B)
= 2 (8 + 3) = **22 metres**
Find the area.
A = L x B = 8 x 3 = **24 m²**

1. The formula for the perimeter of a rectangle is *2(L+B).* What is the distance around a field 300m long and 160m wide?

2(L+B)
=2(300+160)
= €920

2. a) Write the formula for the area of a rectangle.

A = L x B

b) What is the area of the field in question 1 above in metres squared?

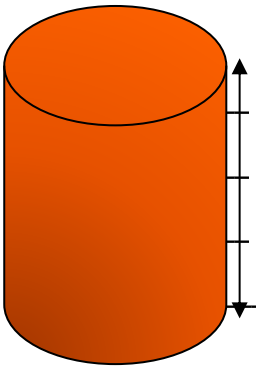
A = 160 x 300)
= 48000m²

1 MARK

Example:
r = radius, h = height
Find the volume of a cylinder where r = 5 cm and h = 12 cm.
$V = \pi r^2 h$
$= 3.14 \times 5^2 \times 12$
$=$ **942 cm³** (Notice that the answer is cubed!)

3. The volume of a cylindrical tank is $\pi r^2 h$ where r is the radius of the base and h is the height.

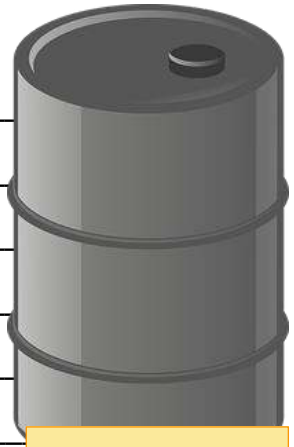
a) Find the volume of the tank when r = 60cm and h = 1.3m.
(π = 3.14)
Remember: 1m = 100 cm



r = 60cm

$V = 1469520\ cm^3$
$(14695.2\ m^3)$

b) Calculate the capacity of the tank in litres. (1 litre = 1000 cm^3)
Capacity is the amount that something can hold.



1469.52 litres

PRACTICE

c) I have a small pill bottle with a volume of 226.08 cm^3. If the height of the pill bottle is 8 cm, what is its diameter?

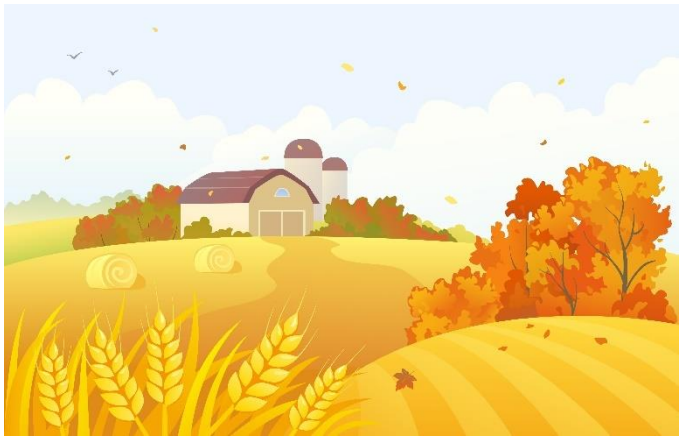
3 cm

d) We purchased an above-ground cylindrical swimming pool. The best space that we had for a pool measured 360 cm across. The tallest pool that we could buy was 120 cm high.
What was the volume of the largest pool that we could buy? Give your answer in cubic centimetres cubic metres.

Volume = 12 208 320 cm^3 or 12.21 m^3
(because 1 000 000 cm3 = 1 m^3)

e) A grain storage, in the shape of a right circular cylinder is 4 feet long in diameter and has a height of 6 feet. Find the volume of the storage. (Use π = 3.14)

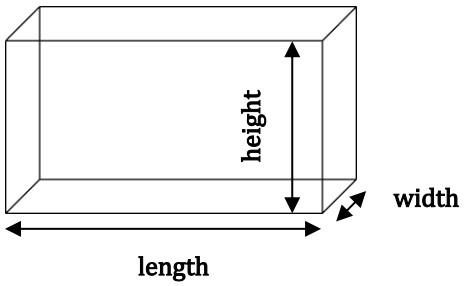
75.36 ft^2



1 MARK

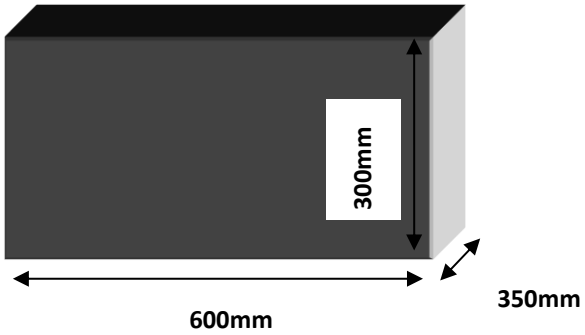
Example
A fish tank has a length of 120 cm, a width 50 cm of and a height of 60 cm. What is the volume of water I will need to fill it? **V = l x b x h**
Volume = 120 × 50 × 60
= 120 × 3000
= 360 000 cm^3
(1000 cm^3 = 1 litre)
Volume of fish tank = **360 litres**.

4. a) I have a small safe at home. Write the formula for the volume of it.



V = L x B x H

b) What is the volume if the sides are 600mm long and 350mm wide and 300mm in height?



63 000 000 mm^3

1 MARK

c) Sinead has a box of chocolates. Its length is 12 cm, its height is 8 cm, and its width is 6 cm. Find the volume of the box.

576 cm^3

d) Find the volume of a cube with a side of 10 metres.

1000 m^3

e) If a farmer wants to plough a field on time, he must plough 120 hectares a day. Because of very bad weather, he ploughed only 85 hectares a day, hence he had to plough 2 more days than he planned, and he still has 40 hectares left. What is the area of the field and how many days did the farmer plan to work initially?

The farmer planned to have the work done in 6 days, and the area of the field is 120x6=720 hectares.

f) Find the approximate volume of a cube whose edge measures 2.35 cm.

Volume = 8 cm^3

g) A rectangular sheet of wood is cut to make a box of length 22 cm and width 13 cm with a volume of 8294 cm^3. Find the height of the box.

Height = 29 cm

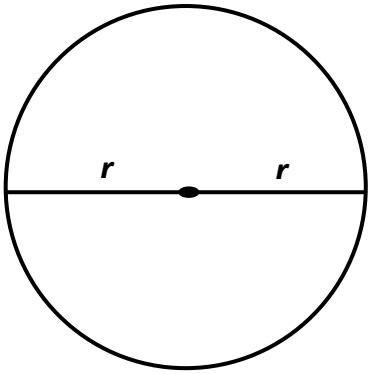
PRACTICE

Example:

What is the area of a circle that has a radius of 3 cm?

$A = \pi r^2$
$= 3.14 \times 3^2$
$= \mathbf{28.26\ cm^2}$

5. Work out the area:



Diameter = 60m

2826 m^2

6. A circular pizza costs €19.99. What is the cost of 1 square centimetre if the diameter of the pizza is 36 cm?

€0.02 per cm^2

1 MARK

I. Algebra for going on a trip

I am going on holiday to a sunny spot. The place where I am going uses miles and not kilometres.

1. a) Write the formula for changing kilometres to miles.

Remember: 1km = about 0.62 miles

If x = kilometres, then the formula is:

0.62x

b) The apartment that I am staying in is 165km from the airport. Convert 165km to miles.

(0.62)(165)

= 102.3 miles

c) Rearrange the formula to show miles to kilometres.

If y = miles, then the formula is:

y/0.62

1 MARK

My baggage allowance is 20kg.

Example:

I can take hand luggage up to 10 kg on the aeroplane.
How will I convert this to pounds?

1 kg = 2.2 pounds

10 x 2.2 = **22 pounds**

2. a) Write the formula for converting kilograms to pounds.

Remember: 1kg = about 2.2 pounds

If x = kg, then the formula is:

2.2x

b) How many pounds in 20kg?

44 pounds

c) Rearrange the formula to show pounds to kilograms.

If y = miles, then the formula is:

y/0.4

1 MARK

The apartment block I am staying in is situated in a holiday park which is 5.6 acres wide.

3. a) Write the formula for converting acres to hectares.
Remember: 1 acre = about 0.4 hectares

If acres = x, then the formula is
0.4x

b) How many hectares in 5.6 acres?

2.24 hectares

c) Write the formula for converting hectares to acres.

If y = hectares, then the formula is
y/0.4

PRACTICE

We have a 32-inch television in our apartment.

4. a) Write the formula for converting metres to inches.

Remember: 1 metre = about 39.4 inches

If metres = x, formula is 39.4x

b) What is the height, in inches, of someone who is 1.7m tall?

66.98 inches

c) Write the formula for converting inches to metres.

If inches = y, formula is y/39.4

1 MARK

We wish to go sailing and the weather forecast states that the wind is 33 knots. Will it be safe to go sailing?

5. a) Write the formula for converting knots to kilometres per hour.

Remember: 1 knot = about 1.85km/h

If knots = x, the formula is 1.85x

b) How many kilometres per hour would 9 knots be?

16.65 km/h

c) Write the formula for converting kilometres per hour to knots.

If km/h = y, then the formula is y/1.85

1 MARK

Next year, you are planning on going to the USA for your holiday.

6. You are planning on going on holiday to America. A currency display shows €1 = $1.19.

a) How many dollars will you get for €x?

1.19x

b) How many dollars will you get for €1300?

$1547

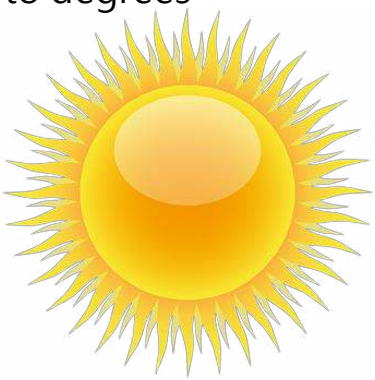
c) If you arrive back in Ireland with $300, how many € will you get, if the exchange rate has remained the same?

€252.10

1 MARK

7. Weather reports usually report the temperature in degrees Centigrade. (°C)

The formula for converting degrees Centigrade to degrees Fahrenheit is:



$F = \frac{9}{5}C + 32$

a) Convert 27°C to degrees Fahrenheit. (°F)

80.6°F

b) The temperature in California is 76°F. Write the formula for the conversion of °F to °C.

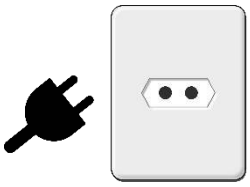
C = 5/9 (F – 32)

c) Find the temperature in California in °C.

24.44°C

1 MARK

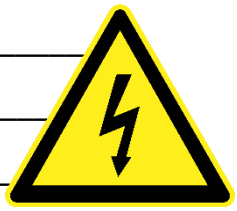
J. Algebra in finance



1. An electricity company charges customers a standing charge of €110.75 and 17c per unit of electricity used.

a) Devise a cost formula for N units of electricity, including the standing charge.

Cost = 17N + €10.75



b) Now add VAT at 13.5% to the formula.

(17N + 10.75) x 13.5%

c) How much will it cost to use 420 units of electricity, including the standard charge and VAT at 13.5%?

€101.04

3 MARKS

e) The cost of an electricity bill can be worked out in the following way:

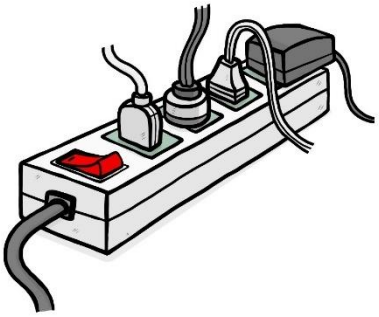
- total cost = (cost per unit) X (number of units) + standing charge

If the cost per unit is 17c, we could write the formula in the following way:

C = 17N + standing charge

Devise a formula to work out the number of units of electricity used (N) if the cost and standing charge is known.

$N = \frac{17N + Standing\ Charge}{17}$

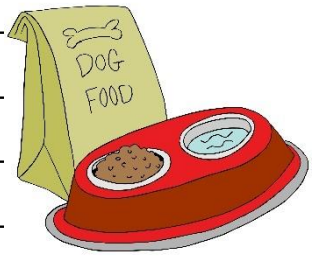


2. You purchased 10 items from the shop, and now you need plastic bags to carry them home. If each bag costs 30c, and can hold only 3 items, how much will you spend on plastic bags?

€1.20

PRACTICE

3. Anne spent €42 on groceries. This was €14 less than twice what she spent on pet food. How much did she spend on pet food?



€28

4. You are dividing €80 among three household bills, so that the second bill will cost twice as much as the first, and the third bill will cost €5 less than the second.

The first bill is €17
The second bill is €34
The third bill is €29

6. Carol spent €35 at the restaurant. This was seven euro less than three times what she spent at the post office. How much did she spend at the restaurant and post office?

€14

7. Wayne spent €100 on tools. This was k euro less than five times what he spent on paint. How much did he spend on paint?

$\frac{100+k}{5}$

2 MARKS

8. There is a budget set aside for a teambuilding work event. The budget is €4000 for the venue and meal. If there are 80 staff members to be invited, is the budget sufficient, given the following information?

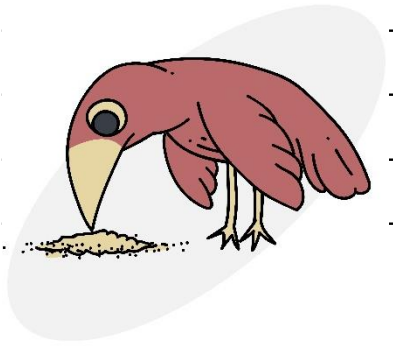
- Speakers & comedy show €800
- Dinner €40 per head
- Tea, coffee and cake @ €8 per head, but only order for half the people, as half will be arriving later

800 + 40(72) + 8(36) = €3,968

The budget is insufficient as it will only cover 72 staff members

9. I sell a wild bird seed mix for €3.00 per kilogram, sunflower seeds for €2.50 per kilogram, and peanuts for €1.75 per kilogram.

How many kilograms of bird seed mix and sunflower seeds should be mixed with 50 kilograms of peanuts to obtain a mixture of 100 kilograms that will sell for €2.30 per kilogram so that the profit or loss is unchanged?



35 kg wild bird seed mix

15 kg of sunflower seeds

2 MARKS

K. Everyday equations

1. What are the dimensions of a rectangle whose length is 4 more than twice the width and whose perimeter is 3 less than 7 times the width?

11 units width
26 units length
74 units perimeter

2. The length of a rectangle is 6cm greater than its breadth.

$(x + 6)cm$

xcm

a) Find in terms of x the perimeter of the rectangle.

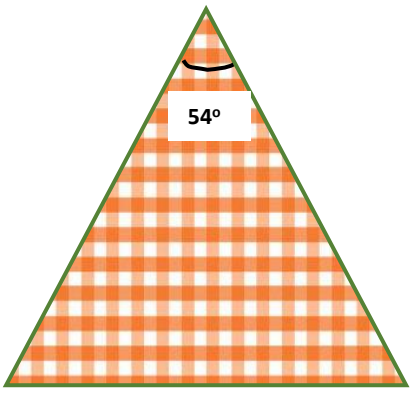
P = 4x + 12

b) If the perimeter of the rectangle is 64cm, find the value of x.

x = 15 cm

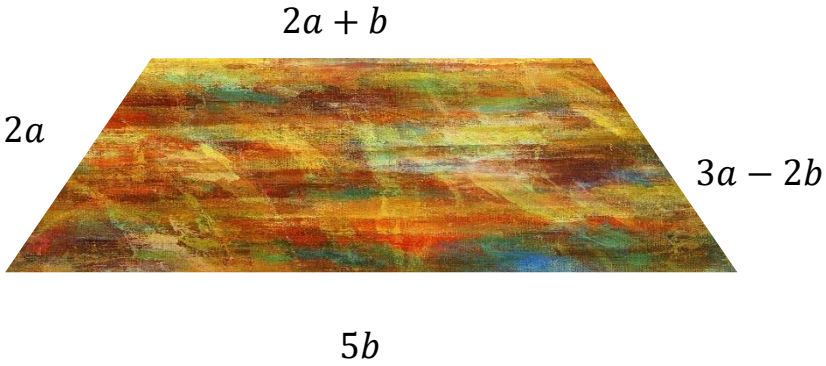
PRACTICE

3. The angles of a triangle add up to 180 degrees. Two angles are equal and the other angle is 54 degrees. Find the equal angles.



The equal angles are 63°

4. P is the perimeter of the given shape.



a) Express P in terms of *a* and *b*.

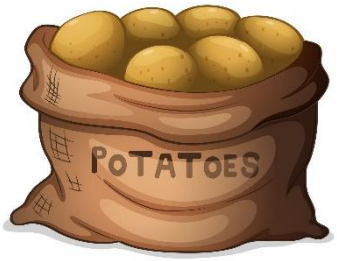
P = 7a + 4b

b) Work out the value of P when *a* = 8 and *b* = 4.

72

PRACTICE

5. A kilogram of sweet potatoes costs 25c more than a kilogram of potatoes. If 3 kg of sweet potatoes costs €12.55, find the cost of a kg of potatoes.



€3.93

6. Darren can paint the kitchen in 4 hours and Alan can paint it in 6 hours. How long will it take the two of them to paint the kitchen if they work together?

2.4 hours

7. The area of a rectangle is 72 cm^2. The width is twice its length. What is the length and width of the rectangle?

Width = 12 cm

I MARK

8. There are b men in the class. This is three more than four times the number of women. How many women are in the class?

$x = \frac{b-3}{4}$

(The solution here is not a number, because it will depend on the value of b.)

9. A factory manufactures its product at a cost of 50 cents per item and sells it for 85 cents per item. Its daily overhead is €600. How many items must be manufactured each day in order for the company to break even?

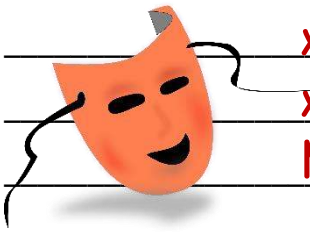
1715 items

10. A few friends are playing a board game. For his first turn, Michael moved ahead 3 spaces, for the second, 5 spaces and for the third, 1 space. For his next turn he had to go back 6 spaces. After that he got a card that said he could move two times the biggest forward move he had done so far. Now how many spaces from the beginning is Michael's game piece?

13 spaces

1.5 MARKS

11. At the local play, there were 266 people, consisting of men, women, and children. There are four times as many men as children, and twice as many women as children. How many of each are there?



x + 4x + 2x = 266
x = 38. 4x = 152. 2x = 76.
Men – 152, Women – 76, Children - 38

12. A design project can be completed by nine employees working eight hours a day for twenty-five days. To speed up the completion of the project this month, the employer hires twelve workers, and wants to complete the project in fifteen days. How many hours a day must the employees work each day, in order to finish on time?

They will need to work ten hours each day.

13. Sharon had €30 in her purse. She spent 1/5 of the money on a sandwich, 1/6 for a coffee, and 1/2 of it on a magazine. How much money does Sharon have left over?

She has €4 left

1.5 MARKS

L. The quadratic formula

1. Solve the following:

The formula to solve the following questions:

- $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

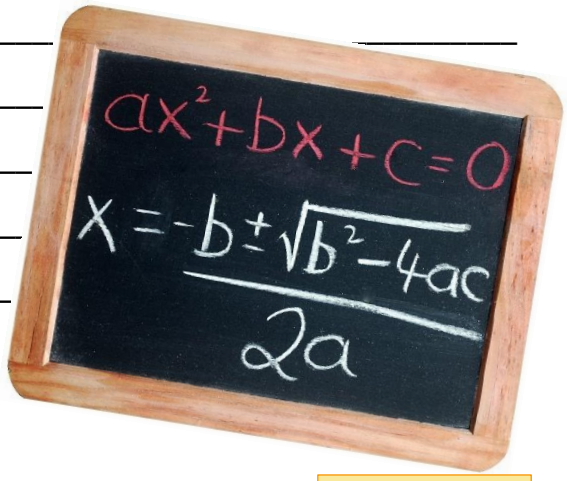
a) Solve $x^2 - 3x - 4 = 0$

$x = -1, 4$

2 MARKS

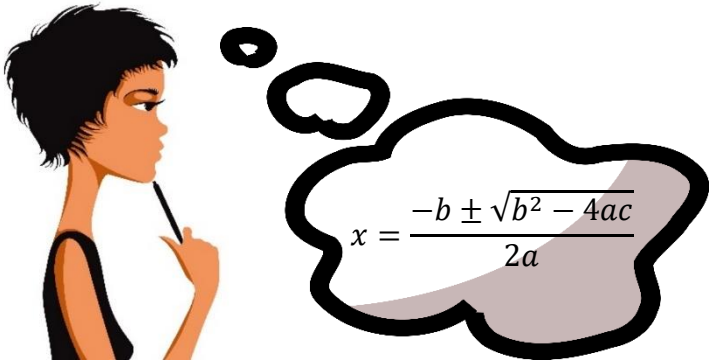
b) $x^2 - 4x + 3 = 0$

$x = 3, 1$



2 MARKS

c) $6x^2 + 11x - 35 = 0$

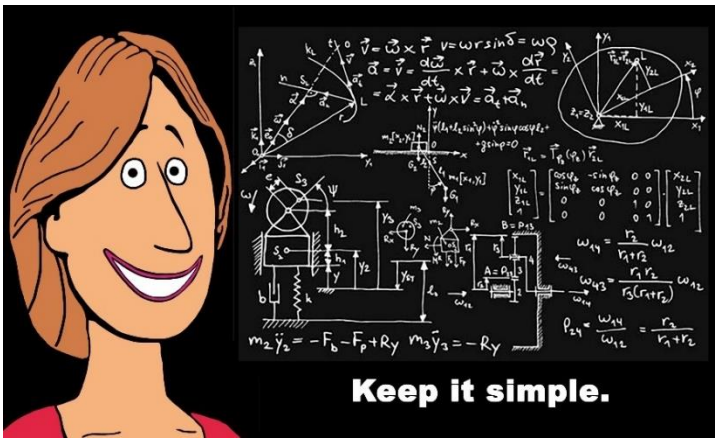


x=-7/2, 5/3

2 MARKS

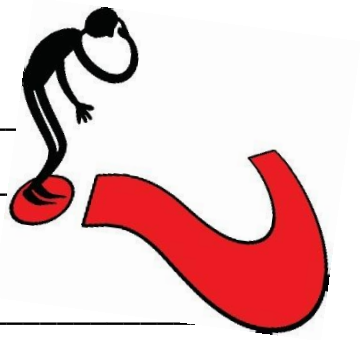
d) Solve $5x^2 + 6x + 1 = 0$

$x = -0.2, -1$



2 MARKS

e) $x^2 - 8 = -2$



$x = -2, -4$

2 MARKS

f) $3x^2 - 13x + 4 = 0$

x = 4, 1/3

2 MARKS

2. Solve the following quadratic equations using the factorising method:

Example:

Solve $x^2 + 5x + 6 = 0$

Find the factors: $x^2 + 5x + 6 =$ **$(x + 2)(x + 3)$**

Restate the original equation in terms of factors:
$(x + 2)(x + 3) = 0$

Now, solve each factor by setting each one equal to zero:

So, **$x + 2 = 0$** or **$x + 3 = 0$**
$x + 2 = 0$ or $x + 3 = 0$
$x = -2$ or $x = -3$
$x = -3, -2$

a) $x^2 - 10x + 16 = 0$

$x = 2, 8$

I MARK

b) $18x^2 - 3x - 6 = 0$

$x = \frac{2}{3}, -\frac{1}{2}$

c) $x^2 - 5x + 3x - 15 = -7$

$x = -2, 4$

2 MARKS

d) $3x^2 + 3x = 2x^2 + 2x + 3x + 3$

$x = -1, 3$

e) $5a^2 + 15a = 0$

$a = 0, -3$

2 MARKS

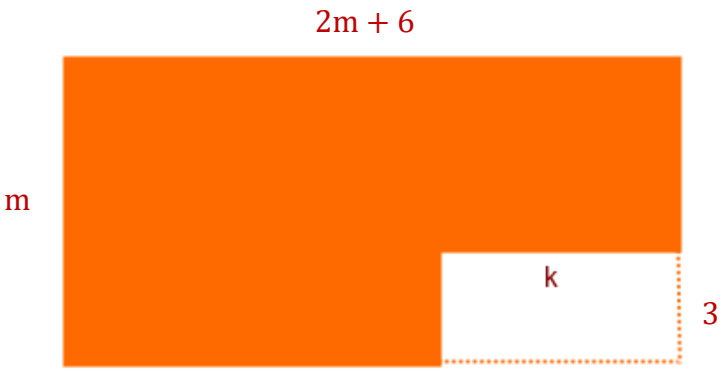
f) The product of two consecutive even integers is 840. Find these numbers.

The numbers are 28 and 30, or -28 and -30

g) The length of a rectangle is 5 cm more than its width and the area is $50cm^2$. Find the length, width and the perimeter. Let the width be x. Then the length = x + 5.

Width = 5cm; so, the length = 10cm.
Perimeter = 30cm.

h) The following picture shows the shape of a rectangle from which a smaller rectangular part is removed. If the remaining area of the larger rectangle is $35cm^2$, find k.



Since the length cannot be negative, k = 3.5.

3 MARKS

M. Simultaneous equations

1. Solve the following simultaneous equations by elimination:

In the 'elimination' method for solving simultaneous equations, two equations are simplified by adding them or subtracting them. This eliminates one of the variables so that the other variable can be found.

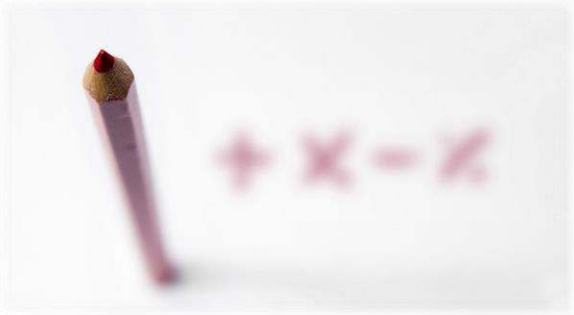
- To add two equations, add the left-hand expressions and right-hand expressions separately. Similarly, to subtract two equations, subtract the left-hand expressions from each other, and subtract the right-hand expressions from each other. The following examples will make this clear.

- Example: Consider these equations:
  $2x - 5y = 1$
  $3x + 5y = 14$
  The first equation contains a '-5y' term, while the second equation contains a '+5y' term. These two terms will cancel if added together, so we will add the equations to eliminate 'y'.

To add the equations, add the left side expressions and the right side expressions separately.

$$\begin{array}{lcl} 2x - 5y & = & 1 \\ + \ 3x + 5y & = & 14 \\ \hline (2x - 5y) + (3x + 5y) & = & 1 + 14 \end{array}$$

Simplifying, -5y and +5y cancel out, so we have:
$5x = 15$
Therefore 'x' is 3.
By substituting 3 for 'x' into either of the two original equations we can find 'y'.



a) $x - y = -6$

$x + y = 8$

The solution is (1, 7)

b) $2x + y = 12$

$-3x + y = 2$

The solution is (2, 8)

2 MARKS

c) $4x + 2y = 14$

$5x + 2y = 16$

The solution is (2, 3)

d) $3x - 4y = 2$

$x + 4y = 10$

The solution is (3, 7/4)

2 MARKS

e) The sum of two numbers is 10. Their difference is 6. What are the two numbers?

The numbers are 8 and 2

1 MARK

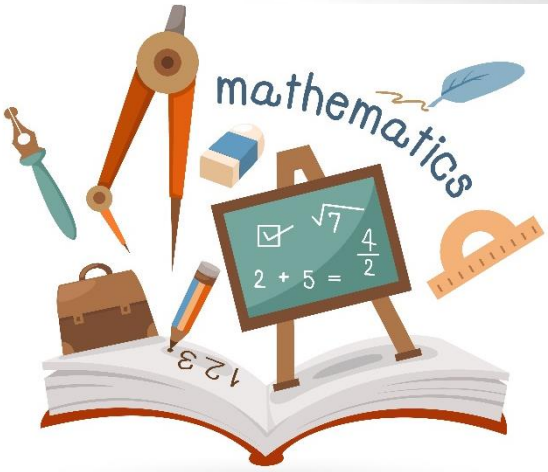
2. Solve the following simultaneous equation by substitution:
Solving' simultaneous equations means finding the values of 'x' and 'y' that make them true. The following steps will demonstrate how to solve simultaneous equations by the substitution method.

Example:
x + y = 3
2x + 3y = 8
(1) Isolate one of the variables ('x') on one side of one of the equations:
- x + y = 3
- Isolating 'x': x = 3 - y

(2) Substitute for the isolated variable in the other equation:
- 2x + 3y = 8
- Substituting 3 - y for 'x': 2(3 - y) + 3y = 8
- This equation has only one variable, so we can solve it.

(3) Solve this equation for the other variable, 'y': 2(3 - y) + 3y = 8
- Expanding the brackets: 6 - 2y + 3y = 8
- Simplifying: 6 + y = 8
- Subtracting 6 from both sides: **y = 2**

(4) Substitute the known value of 'y' into the equation for 'x' derived in step 1: x = 3 - y
- Substituting 2 for 'y': x = 3 - 2
- Therefore: **x = 1**



a) $-3x + y = 6$

$x + 2y = -2$

The solution is (-2, 0)

b) $8x + 10y = 4$

$y = 6x + 2$

The solution is $(-\frac{4}{17}, \frac{10}{17})$

2 MARKS

c) $x - 2y = -10$

$3x - y = 0$

The solution is (2, 6)

d) $x + 3y = 2$

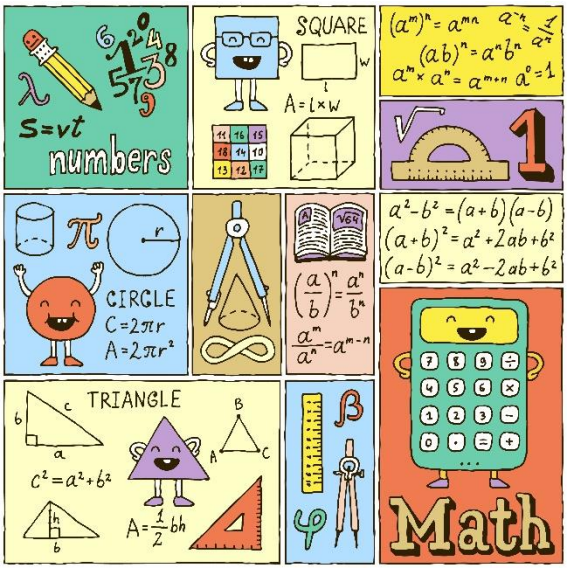
$-x + 2y = 3$

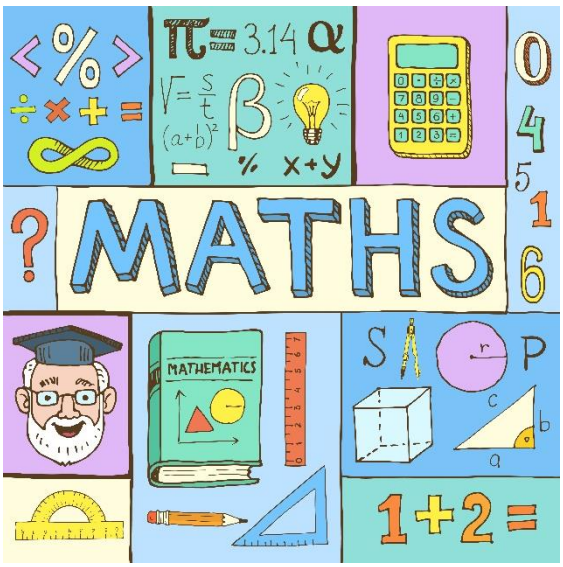
The solution is (-1, 1)

2 MARKS

f) At a local festival, 1000 tickets were sold. Adult tickets cost €8.50, children's cost €4.50, and a total of €7300 was collected. How many tickets of each kind were sold? Hint: Let x be the number of adult tickets and let y be the number of children's tickets.

700 adult tickets, 300 children's tickets

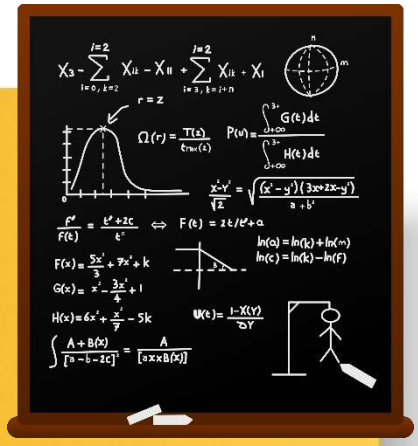




1 MARK

N. Linear Inequalities

1. Solve the following linear inequalities.



Example 1: x + 2 > 12
Subtract 2 from both sides:
x + 2 **− 2** > 12 **− 2**
Simplify:
x > 10

Example 2: 12 < x + 5
If we subtract 5 from both sides, we get:
12 **- 5** < x + 5 **- 5**
7 < x
That is a solution, but it is normal to put "x" on the left-hand side.

So, flip sides (and the inequality sign!):

x > 7

a) $x + 2 < 4$

x<2

1 MARK

b) $2x \leq 4$

$x \leq 2$

c) $-2(x + 4) > 1 - 5x$

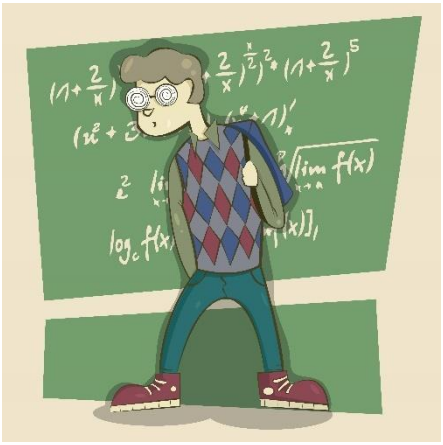
$x > 3$

d) $4 - 6x \geq -15 + 1$

$x \leq 3$

3 MARKS

0. Changing the subject of the formula



The subject of a formula is the single variable to which everything else in the formula is equal. The subject of a formula will usually be positioned to the left of the equals sign. For example: x= 2y + 4z
In this example 'x' is the subject of the formula because everything else is equal to it.

1. Rewrite the following in terms of x:

Example: Rearrange the volume of a box formula (V = lwh) so that the width is the subject

- Start with: V = lwh
- Divide both sides by h: V/h = lw
- Divide both sides by l: V/(hl) = w
- Swap sides: w = V/(hl)

a) $a(x - c) = d$

x = (d + ac)/a

0.5 MARKS

b)$m = 5x - 21$

$x = (m + 21)/5$

c) $4(x - 2y) = 3x + 2$

$x = 2 + 8y$

d) $2(3x - c) = 5c + 1$

$x = (7c + 1)/6$

e) $A = \pi x^2$

$x = \sqrt{\frac{A}{\pi}}$

2 MARKS

2. Change the subject of each formula:

a) $ax = b$ Rewrite in terms of ***a.***

a = b/x, and x ≠ 0

b) $y = mx + c$ Rewrite in terms of ***m.***

m = (y - c)/x and x ≠ 0

c) $F = ma$ Rewrite in terms of ***m.***

m = F/a

d) $y = (x + 5)^2$ Rewrite in terms of ***x.***

$x = \sqrt{y} - 5$

e) $P = \frac{1}{3} Q$ Rewrite in terms of ***Q.***

Q = 3P

2.5 MARKS

MARKING SHEET Level 4 Mathematics, 4N1987 Assignment 3 - Algebra			
Student's name:			
	Max mark	Learner's mark	÷ 4
Variables in everyday life (1 mark – Page 4) (1 mark – Page 5) (2 marks – Page 6) (2 marks – Page 18) (2 marks – Page 19) (2 marks – Page 20) (3 marks – Page 38 – Bills) (2 marks – Page 40 – Finance) (2 marks – Page 41 – Finance) (1.5 marks – Page 45) (1.5 marks – Page 46)	20		
Solving algebraic equations (1 mark – Page 12) (1 mark – Page 14) (1 mark – Page 15) (1 mark – Page 16) (1 mark – Page 17) (1 mark – Page 44) (5 marks – Pages 57 to 60 – each question is 1 mark) (5 marks – Pages 61 to 64 – each question is 1 mark) (4 marks – Pages 65 and 66 – each question is 1 mark)	20		
Solving quadratic equations (12 marks – Pages 47 to 52 – each question is 2 marks) (5 marks – Pages 53 to 55 – each question is 1 mark) (3 marks – Page 56 – each question is 1 mark)	20		
Constructing algebraic expressions / formulae in real-life situations (1 mark – Page 21 - Distance) (2 marks – Page 22 - Capacity) (1 mark – Page 23 - Weight) (1 mark – Page 24 - Interest) (1 mark – Page 25 - Area) (1 mark – Page 27 - Volume) (1 mark – Page 28 - Volume) (1 mark – Page 30 - Area) (1 mark – Page 31 - Distance) (1 mark – Page 32 – Weight) (1 mark – Page 34 - Length) (1 mark – Page 35 – Speed) (1 mark – Page 36 – Currency) (1 mark – Page 37 – Temp) (5 marks – Pages 67 to 69 – each question is ½ mark)	20		
Total	80	20	
Comments			

Tutor signature: _____ Date: _____
Student signature: _____ Date: _____

Mapping of learning outcomes for Level 4 Maths, Assignment 3: Algebra

1 Discuss the presence of variables in a range of real life situations Pages 4, 5 and 6 (variables in everyday life), Pages 18, 19 and 20 (variables in everyday life), Page 38 (variables in household bills), Pages 40 and 41 (variables in everyday finance), Pages 45 and 46 (variables in everyday life, e.g. manufacturing, work project, money)

2 Solve algebraic equations including linear equations of one variable, simultaneous linear equations of two unknowns, and linear inequalities of one variable Page 12 (solving linear equations), Pages 14 to 17 (solving algebraic equations of one variable), Page 44 (solving algebraic equations of one variable), Pages 57 to 60 (simultaneous equations – elimination), Pages 61 to 64 (simultaneous equations – substitution), Pages 65 and 66 (linear inequalities)

3. Solve quadratic equations using factors and the quadratic formula Pages 47 to 52 (solving quadratic equations), Pages 53 to 55 (solving quadratic equations - factorising), Page 56 (solving in everyday life)

4.Construct algebraic expressions and formulae for real life situations using the correct terminology and including rearrangement of formulae. Page 21 (distance), Page 22 (capacity), Page 23 (weight), Page 24 (simple interest), Page 25 (area), Pages 27 and 28 (volume), Page 30 (area – circle), Page 31 (distance), Page 32 (weight), Page 34 (length), Page 35 (speed), Page 36 (currency conversions), Page 37 (temperature), Pages 67 to 69 (changing the subject of a formula)

A note on the marking scheme

The marking scheme is an example of how marks can be broken down.

Marks have been divided as such:

- Variables in everyday life – 20 marks
- Solving algebraic equations – 20 marks
- Solving quadratic equations – 20 marks
- Constructing algebraic expressions / formulae in real-life situations – 20 marks

TOTAL: 80 marks ÷ 4 = 20 marks

You can deduct marks for:

- Incorrect/illogical layout
- Omitting units of measurement in final answers
- Answers not correct to 2 decimal places, where applicable
- More than 2 attempts
- Blunders - mathematical errors/omissions
- Slips - numerical errors
- Misreadings
- Late submissions

There are **suggested** mark allocations throughout the assignment with some exercises named as **Practice**. Where, for example, 1 mark is allocated for several questions, you can multiply all such questions by the same number, and then divide. Or you may have an alternative way to assess the assignment. However marks are allocated, ensure that adequate weighting is given to each learning outcome in this section.

Extra space