



Problem Solving with Algebra

Name: Answers

Class: _____

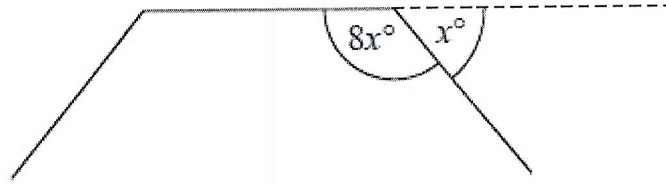
Time: 1 hour 20 mins

Total marks available: 70

Total marks achieved: _____

Q1.

The diagram shows three sides of a regular polygon.



The size of each exterior angle of the regular polygon is x° .
The size of each interior angle of the regular polygon is $8x^\circ$.

Work out the number of sides the regular polygon has.

$$8x + x = 180^\circ$$

$$9x = 180^\circ$$

$$x = 20^\circ$$

$$360^\circ \div 20^\circ = 18 \text{ sides.}$$

(Total for question = 3 marks)

Q2.

The diagram shows **shape A**.

All the measurements are in centimetres.

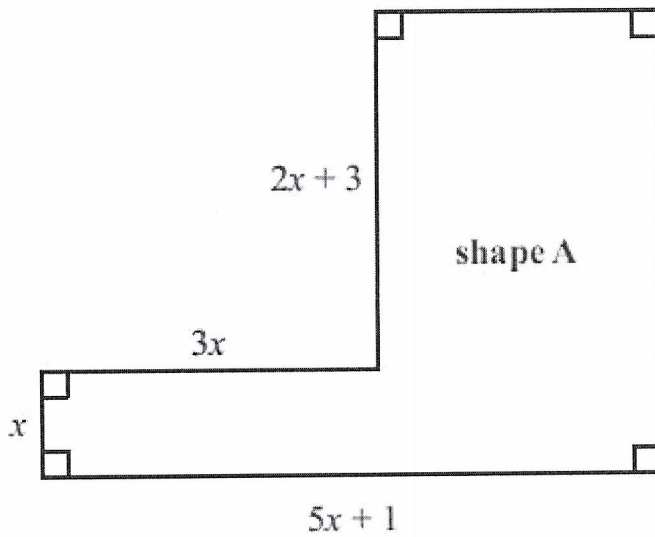


Diagram **NOT**
accurately drawn

(a) Find an expression, in terms of x , for the perimeter of **shape A**.

$$5x + 1 + 5x + 1 + 3x + 3 + 3x + 3$$

$$\dots 16x + 8 \dots$$

(3)

A square has the same perimeter as **shape A**.

(b) Find an expression, in terms of x , for the length of one side of this square.

$$\frac{16x + 8}{4}$$

$$\dots 4x + 2 \dots$$

(1)

(Total for Question is 4 marks)

Q3.

ABC is a triangle.

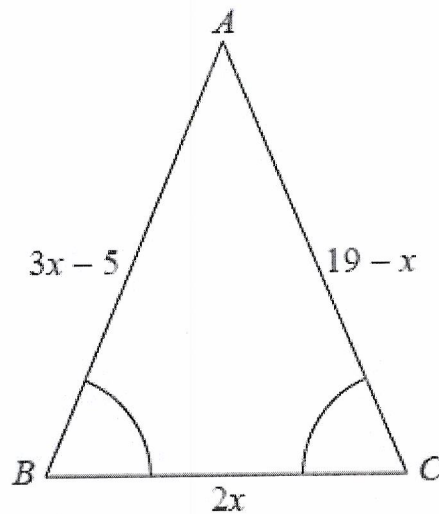


Diagram NOT
accurately drawn

Angle $ABC =$ angle BCA .

The length of side AB is $(3x - 5)$ cm.

The length of side AC is $(19 - x)$ cm.

The length of side BC is $2x$ cm.

Work out the perimeter of the triangle.

Give your answer as a number of centimetres.

$$3x - 5 = 19 - x$$

$$4x = 24$$

$$x = 6$$

$$3x - 5 = 3 \times 6 - 5 = 13 \text{ cm}$$

$$19 - x = 19 - 6 = 13 \text{ cm}$$

$$2x = 2 \times 6 = 12 \text{ cm}$$

$$13 + 13 + 12 = 38 \text{ cm}$$

..... 38

(Total for Question is 5 marks)

Q4.

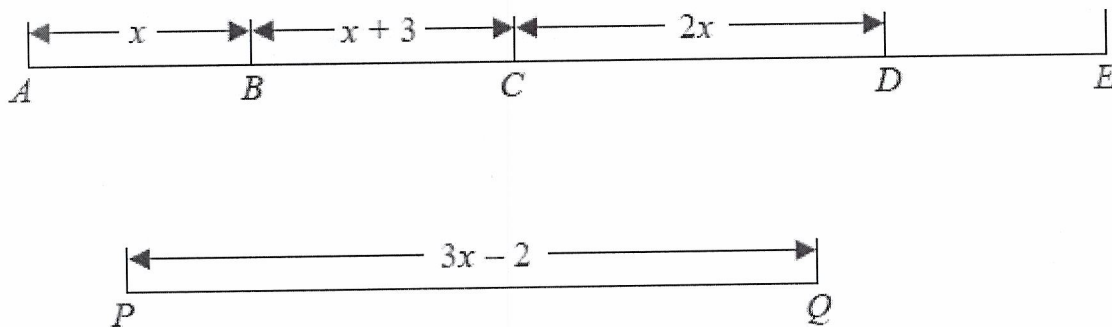
(a) Expand $5(2c + 3d)$

$$10c + 15d$$

(1)

(b) Here are two straight lines, $ABCDE$ and PQ .

Diagrams NOT
accurately drawn



In the diagrams all the lengths are in cm.

$$AE = 2PQ.$$

Find an expression, in terms of x , for the length of DE .

Give your answer in its simplest form.

$$2PQ = 2(3x - 2) = 6x - 4$$

$$AD = x + x + 3 + 2x = 4x + 3$$

$$DE = (6x - 4) - (4x + 3)$$

$$2x - 7$$

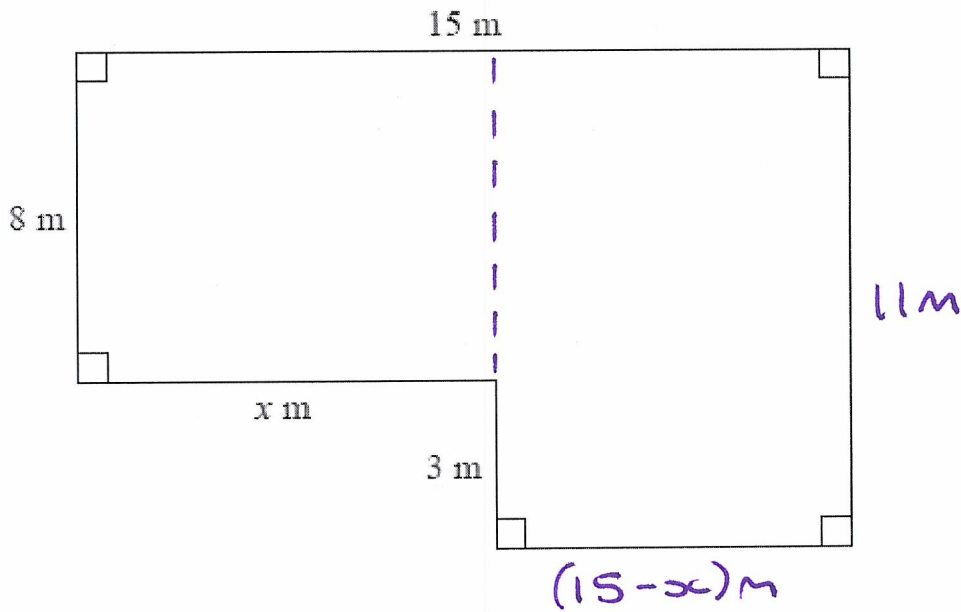
cm

(4)

(Total for Question is 5 marks)

Q5.

The diagram shows the plan of a floor.



The area of the floor is 138 m^2 .

Work out the value of x .

$$\begin{aligned} 11(15-x) + 8x &= 138 \\ 165 - 11x + 8x &= 138 \\ -3x &= -27 \\ x &= 9 \end{aligned}$$

$x = 9$

(Total for Question is 4 marks)

Q6.

Here is a rectangle.

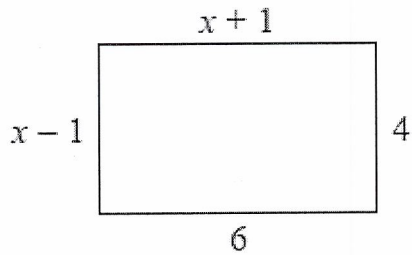


Diagram NOT
accurately drawn

All measurements on the diagram are in centimetres.

(a) Find the value of x .

$$\begin{aligned}x - 1 &= 4 \\x &= 5\end{aligned}$$

$$x = 5$$

(2)

Here is a triangle.

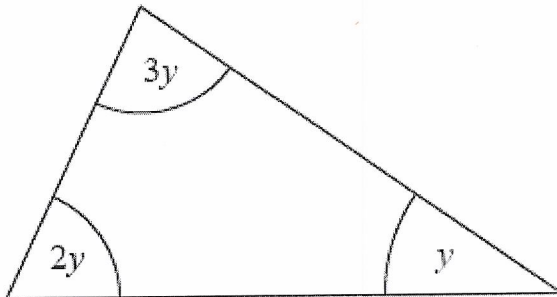


Diagram NOT
accurately drawn

(b) Find the size of the angle marked y .

$$\begin{aligned}3y + 2y + y &= 180^\circ \\6y &= 180^\circ \\y &= 30^\circ\end{aligned}$$

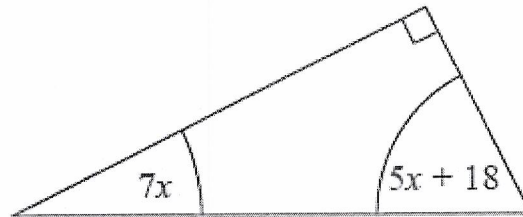
$$30$$

(2)

(Total for question = 4 marks)

Q7.

The diagram shows a right-angled triangle.



All the angles are in degrees.

Work out the size of the smallest angle of the triangle.

$$7x + 90 + 5x + 18 = 180^\circ$$

$$12x = 72^\circ$$

$$x = 6^\circ$$

$$7x = 7 \times 6 = 42^\circ$$

$$5x + 18 = 5 \times 6 + 18 = 48^\circ$$

..... 42

(Total for question is 3 marks)

Q8.

You can use this rule to work out the total hire charge, in pounds (£), for hiring a satellite phone.

$$\text{Total hire charge} = \text{number of weeks} \times 90 + 50$$

Ismail wants to hire a satellite phone for 4 weeks.

(a) Work out the total hire charge.

$$4 \times 90 + 50$$

£.....410.....
(2)

Dominik hires a satellite phone.
His total hire charge is £ 860

(b) For how many weeks did he hire the phone?

$$\begin{aligned} 90w + 50 &= 860 \\ 90w &= 810 \\ w &= 9 \end{aligned}$$

.....9..... weeks
(3)

(Total for question = 5 marks)

Q9.

The diagram shows a garden in the shape of a rectangle.

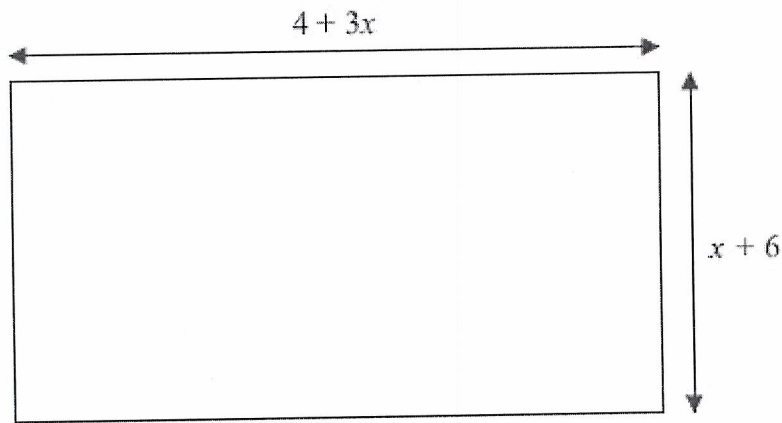


Diagram NOT
accurately drawn

All measurements are in metres.

The perimeter of the garden is 32 metres.

Work out the value of x

$$\begin{aligned}4 + 3x + 4 + 3x + x + 6 + x + 6 &= 32 \\8x + 20 &= 32 \\8x &= 12 \\x &= 1.5\end{aligned}$$

$$x = 1.5$$

(Total for Question is 4 marks)

Q10.

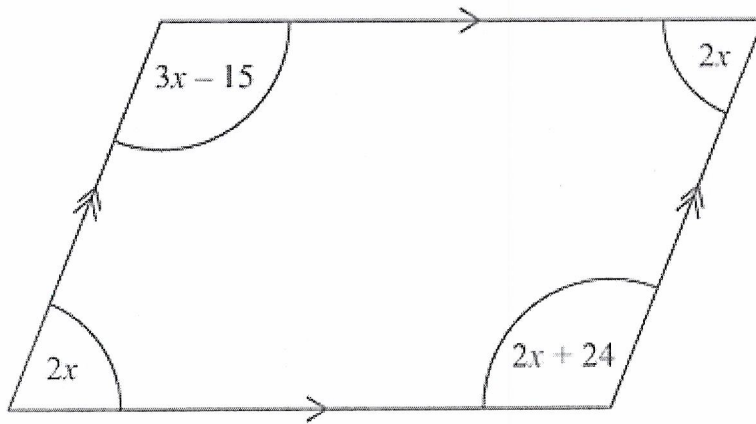


Diagram **NOT**
accurately drawn

The diagram shows a parallelogram.
The sizes of the angles, in degrees, are

- $2x$
- $3x - 15$
- $2x$
- $2x + 24$

Work out the value of x .

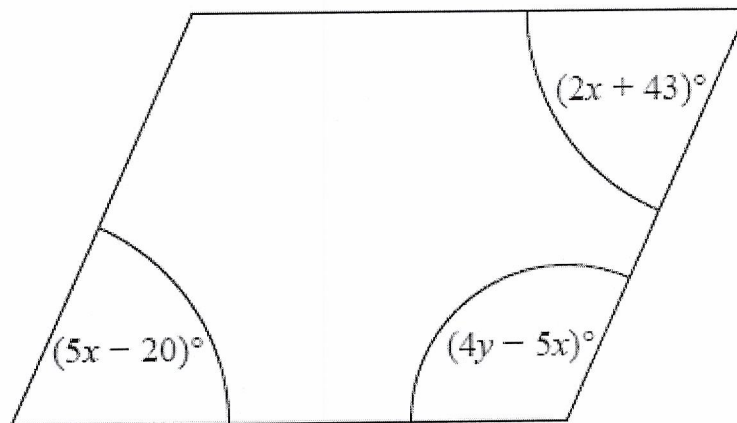
$$3x - 15 = 2x + 24$$
$$x = 39^\circ$$

$$x = \dots 39^\circ \dots$$

(Total for Question is 3 marks)

Q11.

Here is a parallelogram.



Work out the value of x and the value of y .

$$2x + 43 = 5x - 20$$

$$63 = 3x$$

$$21 = x$$

$$\cancel{5x} - 20 + 4y - \cancel{5x} = 180^\circ$$

$$4y = 200^\circ$$

$$y = 50^\circ$$

$$x = \dots 21^\circ \dots$$

$$y = \dots 50^\circ \dots$$

(Total for question = 5 marks)

Q12.



Take two 5 m/ spoons full
twice a day

There are 300 m/ of medicine in a bottle.
Mary has to take two 5 m/ spoons full of medicine twice a day.
Mary has to take the medicine until the bottle is empty.

(a) How many days does Mary have to take the medicine for?

$$2 \times 5 \times 2 = 20 \text{ ml per day}$$
$$\frac{300}{20} = 15 \text{ days}$$

..... 15 days
(3)

You can work out the amount of medicine, c m/, to give to a child by using the formula

$$c = \frac{ma}{150}$$

m is the age of the child, in months.

a is an adult dose, in m/.

A child is 30 months old.

An adult's dose is 40 m/.

(b) Work out the amount of medicine you can give to the child.

$$\frac{30 \times 40}{150} = \frac{1200}{150} = 8 \text{ ml}$$

..... 8 m/
(2)

(Total for Question is 5 marks)

Q13.

* This formula is used to work out the body mass index, B , for a person of mass M kg and height H metres.

$$B = \frac{M}{H^2}$$

A person with a body mass index between 25 and 30 is overweight.

Arthur has a mass of 96 kg.
He has a height of 2 metres.

Is Arthur overweight?
You must show all your working.

$$\frac{96}{2^2} = \frac{96}{4} = 24$$

Arthur is not overweight.

(Total for Question is 3 marks)

Q14.

Here is information about the cost of sending a parcel to Europe by Parcel Link.

Next day delivery	£19.00 plus 70p for each kg more than 5 kg
3 day delivery	£16.00 plus 50p for each kg more than 5 kg

Kate is going to send a parcel to Europe by Parcel Link.
The parcel weighs 12 kg.

Kate can send the parcel using next day delivery or using 3 day delivery.

(a) Work out the difference in the two costs.

$$12 - 5 = 7 \text{ kg payable}$$

$$\text{Next day} \rightarrow 19 + 0.7 \times 7 = \text{£}23.90$$

$$\text{3 day} \rightarrow 16 + 0.5 \times 7 = \text{£}19.50$$

$$4.40$$

£ 4.40

(3)

Adam sends a parcel to Europe by Parcel Link.
He uses 3 day delivery.

The cost is £25

(b) Work out how many kilograms Adam's parcel weighs.

$$16 + 0.5x = 25$$

$$0.5x = 9$$

$$x = 18 \text{ kg}$$

18

kg

(3)

(Total for question = 6 marks)

Q15.

Penelope is going to cook a chicken.

She uses this rule to find the cooking time.

cooking time = 20 minutes for each 0.5 kg + 10 minutes

The chicken has a weight of 2 kg. $= 4 \times 0.5 \text{ kg}$

Penelope wants to finish cooking the chicken at 12 30 pm.

What time should Penelope start cooking the chicken?

$$20 \times 4 + 10 = 90 \text{ mins} = 1 \text{ hr } 30 \text{ mins}$$

$$12:30 - 1 \text{ hr } 30 \text{ mins} = 11:00 \text{ am}$$

..... 11:00 am

(Total for question = 4 marks)

Q16.

You can use these rules to change temperatures from °C to °F.

approximate rule Multiply the °C temperature by 2 and then add 30

exact rule Multiply the °C temperature by 1.8 and then add 32

Amy uses the **approximate rule** to change 20°C to °F.
Dan uses the **exact rule** to change 20°C to °F.

(a) Work out the difference between Amy's result and Dan's result.

$$\begin{aligned} \text{Approximate} &\rightarrow 20 \times 2 + 30 = 70^\circ\text{F} \\ \text{Exact} &\rightarrow 20 \times 1.8 + 32 = \frac{68^\circ\text{F}}{2^\circ\text{F}} \end{aligned}$$

..... 2 °F
(4)

Jade uses the **approximate rule** to change a temperature from °C to °F.
The result is 110°F.

(b) What °C temperature did Jade change to °F?

$$\begin{aligned} 2c + 30 &= 110 \\ 2c &= 80 \\ c &= 40^\circ\text{C} \end{aligned}$$

..... 40 °C
(3)

(Total for Question is 7 marks)