MathsMadeEasy

GCSE Mathematics

Calculator

Higher Tier

Mock 2, paper 2

ANSWERS

1 hour 45 minutes

Legend used in answers

Blue dotted boxes – instructions or key points

Start with a column or row that has only one number missing

Green Box - Working out

5b means five times b
b = -3 so 5 x -3 = -15

Red Box and ✓ - Answer

✓ 48 %

24

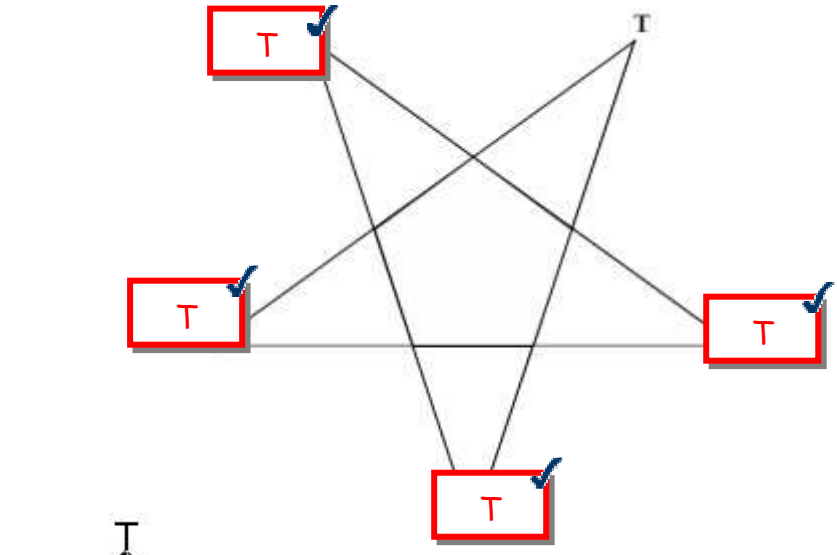
Marks shown in brackets for each question (2)

Authors Note

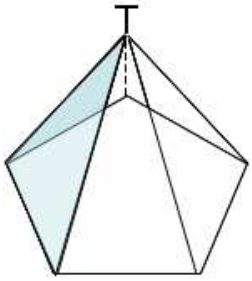
Every possible effort has been made to ensure that everything in this paper is accurate and the author cannot accept responsibility for any errors.

1. a) A net of a 3-D shape is shown below. It folds together to make the 3-D shape. Four other vertices meet at T.

Mark these four vertices with a letter T



(2)



The triangular sides fold upwards to hit the top or vertices of the shape

b) A square is shown below with an area of 441 cm^2

Area
441 cm^2

Diagram NOT drawn accurately

(2)

What is the length of one side of this square?

$\sqrt{441} = 21$ cm

2. Jane, David and Laura share 44 sticks of chewing gum in the ratio 2: 4: 5

Calculate how many sticks each received

Find out what a ratio of 1 is
Add up the ratios and divide total

2 + 4 + 5 = 11

44 ÷ 11 = 4

Once a ratio of 1 is found
Use it to multiply terms given

Ratio 2 = 2x4 = 8

Ratio 4 = 4x4 = 16

Ratio 5 = 5x4 = 20

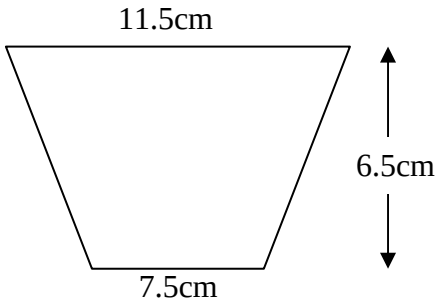
All ratios add up to 44

Jane…. Jane 8
David… David 16
Laura 20

Laura……sticks

(3)

3. Work out the area of the shape below.



shape not drawn accurately

Area of trapezium = (11.5 + 7.5)/2 × 6.5

61.75 cm^2

(3)

4. The sales price of a coat was £112 in the sale.
There was 25% off.
Calculate the original price of the coat.

we paid 75% of original and that is £112
so 0.75 × original = 112 or original = 112 ÷ 0.75 = 149.33

£149.33

(3)

5. There are 800 pupils at Toddington School.
The table shows information about the pupils.

Year	Boys	Girls
Year 7	96	86
Year 8	98	85
Year 9	86	74
Year 10	73	77
Year 11	65	60

An inspector is carrying out a survey into pupils' views about the school.
He takes a sample, stratified both by Year group and by gender, of 50 of the 800 pupils.

Calculate the number of Year 7 boys to be sampled.

'Strata' means 'layer'. A stratified sample is made up of different 'layers'. The sample size is proportional to the size of the 'layer'.

5 0 ÷ 8 0 0 x 9 6 = 6

(3)

6.

WXY is a right angled triangle.
WX = 9 cm
XY = 11 cm

Calculate the length of WY to two decimal places.

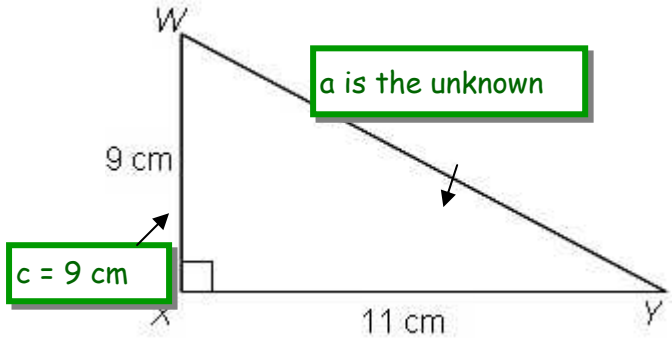


Diagram NOT drawn accurately

a is the unknown

Pythagoras Theorem
$a^2 = b^2 + c^2$

c = 9 cm

b = 11 cm

$a^2 = 11^2 + 9^2$

$a^2 = 121+81 = 202$

$a = \sqrt{202} = 14.2126$

14.21 ✓

…….cm.

√ (1 1 x 1 1 + 9 x 9) =

Use brackets on your calculator and get the answer in one go

7. Work out $\dfrac{\sqrt{3.46+4.78}}{7.659-4.67}$

Write own all the figures on your calculator di

Calculators do operations in a particular order. Use brackets to force it to do what you want

√ (3 . 4 6 + 4 . 7 8) ÷

(7 . 6 5 9 - 4 . 6 7) =

(2)

0.96036802 ✓

(1)

Now give your answer to two decimal places

0.96

…….

8. Jane recorded the time in minutes it took her to cook dinner for thirty two days
She wrote her results in the following table.

Take mid-value from each class interval

27.5
32.5
37.5
42.5
47.5

Time (t mins)	Frequency
$25 \leq t < 30$	2
$30 \leq t < 35$	5
$35 \leq t < 40$	6
$40 \leq t < 45$	9
$45 \leq t < 50$	10

Count down using frequency column

The 16th and 17th term is in this class interval

(1)

a) Write down the class interval in which the median lies

MEDIAN is the middle value

There are 32 values so pick the number between the 16th and 17th

$40 < t \leq 45$ ✓

b) Work out an estimate of the mean time it took Jane to cook dinner.

MEAN = $\frac{\text{Total Time taken to cook all dinners}}{\text{Number of Dinners}}$

DON'T add up the class intervals and divide by the total frequency (32)

For each class interval we estimate the time taken
Use the mid value from each class x frequency

Class	mid	x freq	sub-total (mins)
25-30	27.5	x 2	= 55
30-35	32.5	x 5	= 162.5
35-40	37.5	x 6	= 225
40-45	42.5	x 9	= 382.5
45-50	47.5	x 10	= 475
			1300

Mean = $\frac{1300^{325}}{32_{8}} = 40.625$ minutes

40.625 ✓

(4)

……..minutes

9. Cyril paid £100 into a bank.
The rate of interest was 4% compound per year.
How much was in the bank after 3 years.

Compound means you get interest on the interest

Can work out 4% each year and add it on then work out the next years interest or use a formula:

amount times 1 + interest as decimal ^{years} = 100×1.04^3

£112.49 **(3)**

10. Solve the simultaneous equation below:

$6x + 5y = 15$

$5x - 5y = 40$

Simultaneous equations are two equations with the same values for x and y

We can eliminate y by adding the two equations together

When solving equations make sure you only have x or y

$6x + 5x = 11x$

$5y - 5y = 0$

$15 + 40 = 55$

$11x = 55$ so $x = 5$

SUBSTITUTE $x=5$

$6x + 5y = 15$

$6 \times 5 + 5y = 15$

$30 + 5y = 15$

Take 30 from both sides

$30 - 30 + 5y = 15 - 30$

$5y = -15$ so $y = -3$

x..... 5 ✓

y..... –3 ✓ **(3)**

11. a) Work out the size of angle x in the right angled triangle shown below.
Give your answer correct to three significant figures

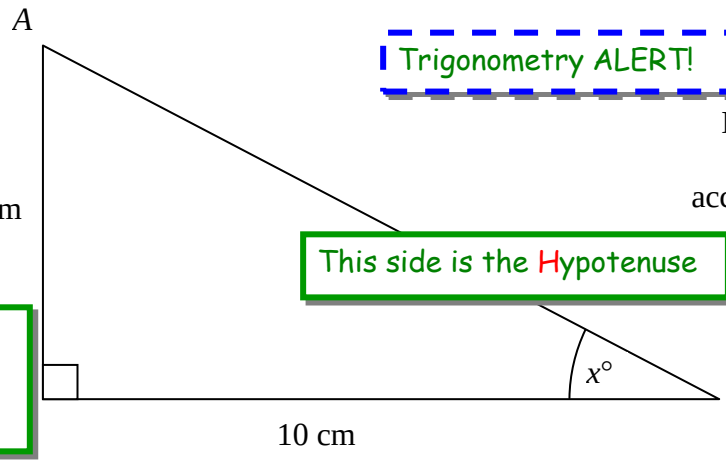


Diagram **NOT** accurately drawn

Trigonometry ALERT!

This side is the Hypotenuse

This side is OPPOSITE (O) from x

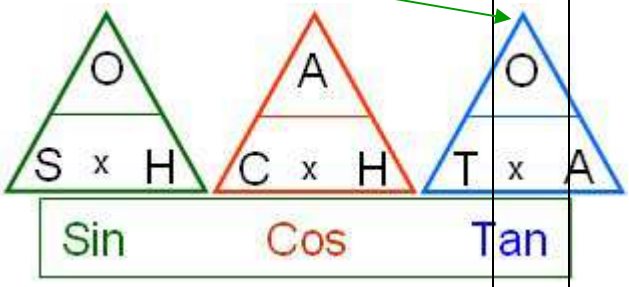
This side is ADJACENT(A) (next to) to x

Keep forgetting SOHCAHTOA? Try:
Some Old Hags
Cant Always Handle
Their Old Age

Using the Trig formulae

Which Trig formula do we want?
Find the one that has A and O.
It's TAN

Cover up T because we want to find this and the formula is $T = \frac{O}{A}$



REMEMBER:
Use Tan $^{-1}$ on your calculator
When you want to find an angle

$\text{Tan}^{-1} x = \frac{6}{10} = 30.96$

3 significant figures round up to 31.0

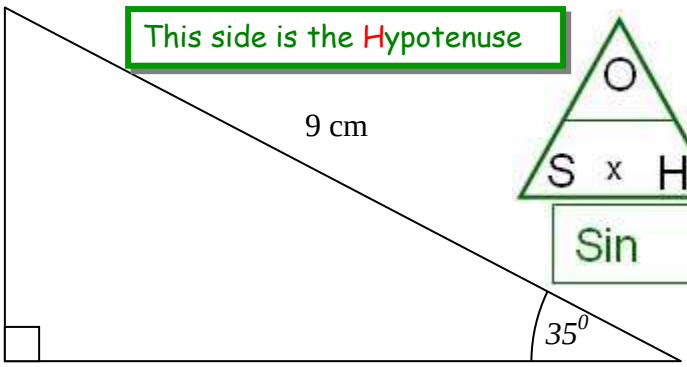
shift **tan-1** **(** **6** **÷** **1** **0** **)** **=**

Use brackets to make sure your calculator does what you want it to.
How else could you do it?

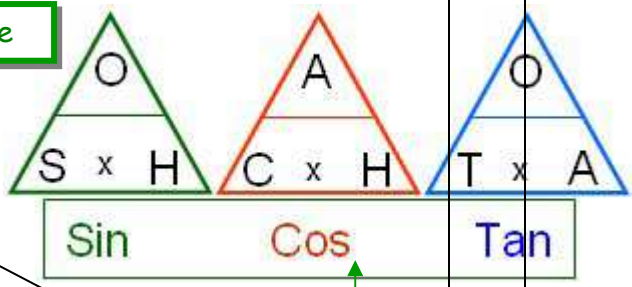
x = 31.0 ✓

(3)

11. b) Work out the length of the side A in the right angled triangle below.
Give your answer correct to 2 significant places.



This side is the Hypotenuse



This side is ADJACENT(A) (next to) to *x*

Which Trig formula do we want?
Find the one that has A and H.
It's COS

Cover up A because we want to find this and the formula is A = C x H

A = C x H = Cos 35^0 x 9 cm

cos 3 5 x 9 =

A = 0.819 x 9 = 7.372 cm

Round up to 4

7.4 ✓ .....cm **(3)**

Significant figures is a rounding method .The closer a digit is to the beginning of a number, the more significant, it is.

12.

Remember going in the opposite direction reverses the sign.

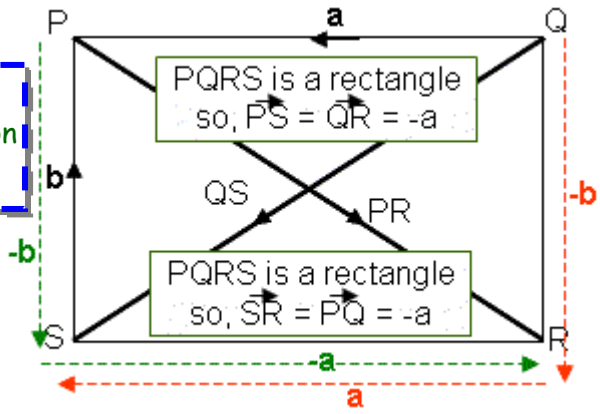


Diagram not drawn accurately

PQRS is a rectangle
PQ is parallel to SR
PS is parallel to QR

$\overrightarrow{PQ} = -\mathbf{a}$ $\overrightarrow{SP} = \mathbf{b}$

a) Express in terms of a and b

i) $\overrightarrow{PR}$

We can go from P to R by moving down PS (-b) and across SR (-a). So SR is PS = PS + SR = - b - a

–b – a ✓

ii) $\overrightarrow{QS}$

We can go from Q to S by moving down QR (-b) and across RS (a). So QS = QR + RS = - b + a

–b + a ✓

(2)

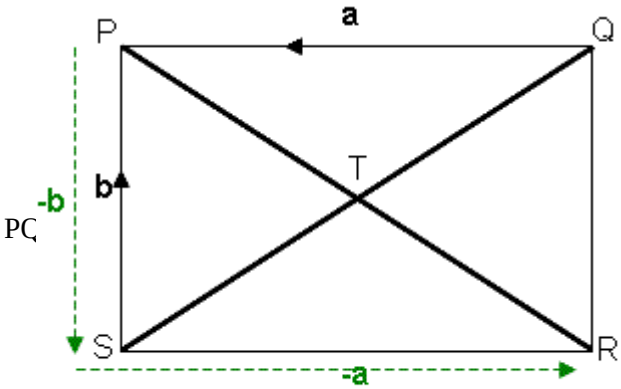


Diagram not drawn accurately

PR and SQ are diagonals of the square

PR and SQ intersect at T

b) Express $\overrightarrow{PT}$ in terms of **a** and **b**

PT is ½ PR

–½ (b + a) ✓

(1)

Find PR = -b – a or – (b + a)

So PT = - ½ (b + a)

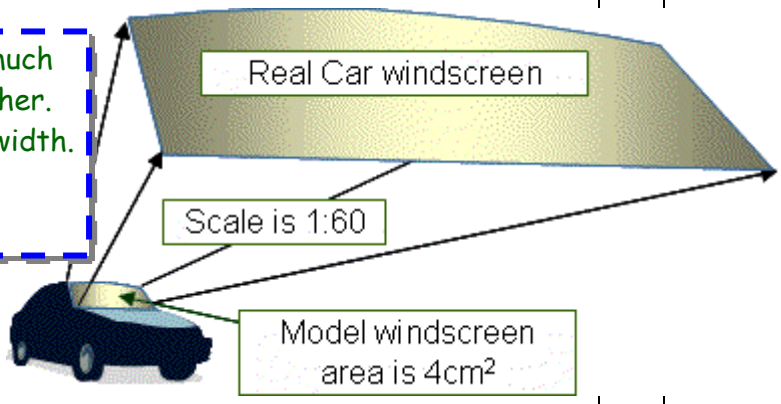
13. Matthew builds a model of an Audi TT car.

He uses a scale of 1:60

The area of the window screen on his model is 4 cm^2.

Work out the area of the window screen on the real car.

A scale is a number which tells you how much bigger (or smaller) one thing is than another.
The scale (S) only works for a length or width.
For areas you have to square it
For volumes you have to cube it



The scale is 60 so the real windscreen is 60 times the model windscreen

But the scale only works with a length or a width *not* the area

If model area = length x width, the real area is model length x S x model height X S

So real windscreen area is model area x S^2 = 4 x 60 x 60 = 14400 cm^2

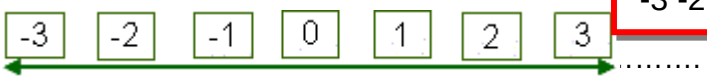
14400 ✓ $.cm^2$ **(2)**

14. a) What are all the possible integer values of x such that

$-3 \leq x < 4$

This means x is greater or equal to minus 3

This means x is less than 4



-3 -2 -1 ,0, 1, 2, 3 ✓

(2)

On a number line we can go up to -3 but not as far as 4

b) Solve the inequality

$5a - 16 < 8 - a$

Change the < to an = sign → $5a - 16 = 8 - a$ and solve it

$5a - 16 = 8 - a$ → $5a - 16 + a = 8 - a + a$ → $6a - 16 = 8$ → $6a - 16 + 16 = 8 + 16$

add a to both sides

add 16 to both sides

$6a = 24$

Put the = sign back to a < sign …

$6a < 24$

So $a < 4$ ✓

(2)

c) Factorise

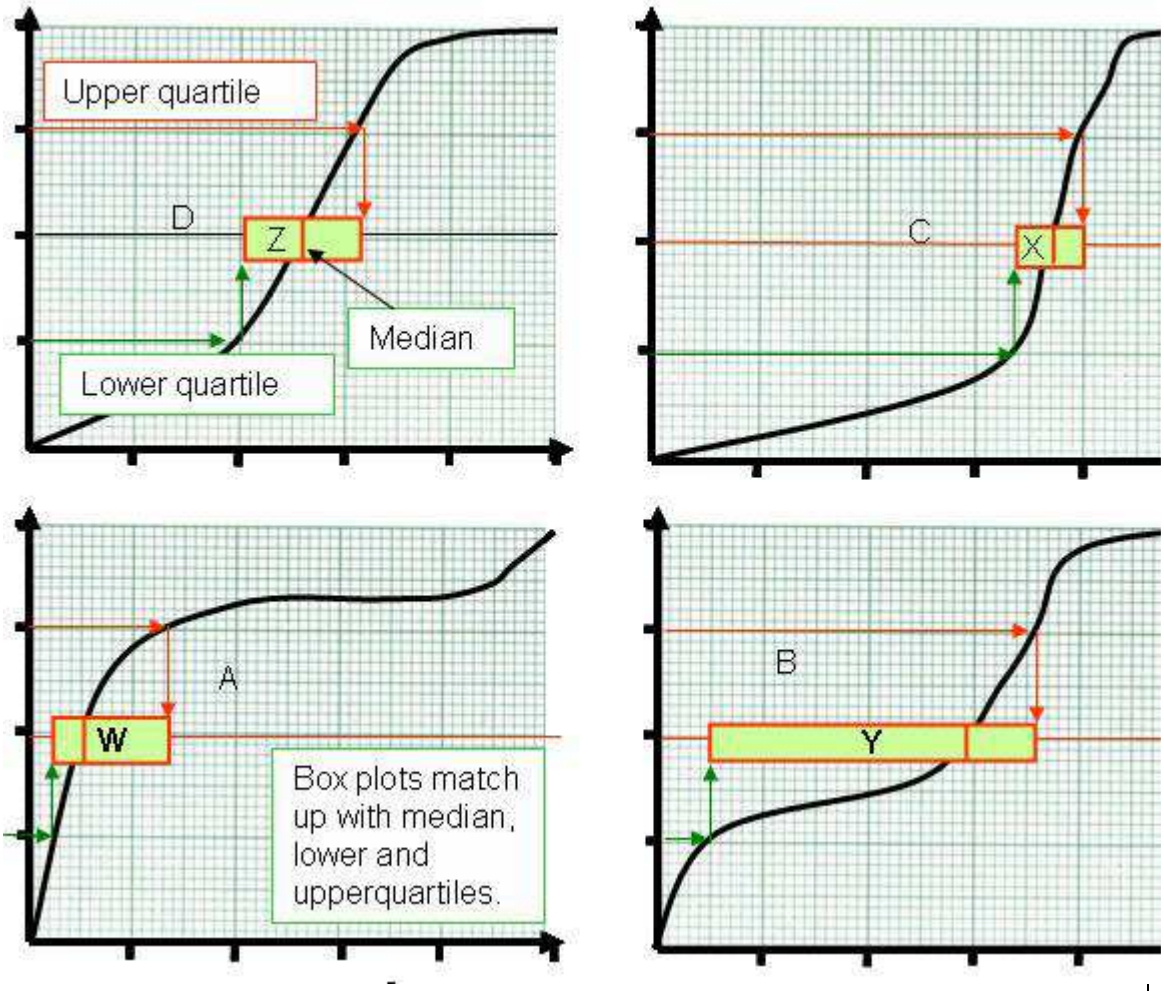
$x^2 + 7x + 10$

Find two numbers that multiply to make 10 and you can add or subtract to make 7

$(x + 5)(x + 2)$ ✓

(2)

15. Below are four cumulative frequency diagrams



For each box plot write the letter of the appropriate cumulative frequency diagram

Each part of the box plot lines up with points on the curves as shown above:
start of range;
lower quartile (1/4);
Median (1/2)
Upper quartile (3/4)
end of range

W and ..... A ✓

X and ..... C ✓

Y and ..... B ✓

Z and ..... D ✓

(2)

16. The table and histogram show information about the time it took some students to run 120 metres.

Time (t seconds)	Frequency
$0 < t \leq 15$	18
$15 < t \leq 20$	12
$20 < t \leq 30$	20
$30 < t \leq 50$	12
$50 < t \leq 56$	15
$56 < t \leq 60$	4

this is the area of the histogram

15 × 1.2 = 18

5 × 2.4 = 12

10 × 2

20 × 0.6

6 × 2.5

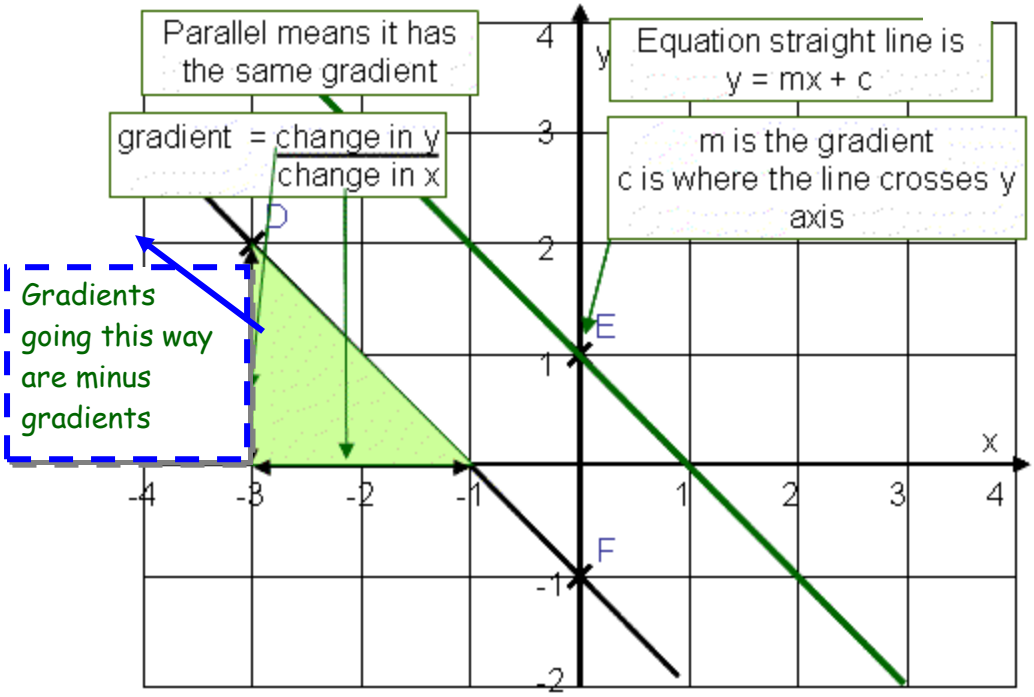
4 × 1

a) Use the table to complete the histogram **(2)**

b) Use the histogram to complete the table

(2)

17.



In the diagram above

D is the point (-3, 2)
E is the point (0, 1)
F is the point (0, -1)

There is a straight line that passes through E and is parallel to DF.
Find the equation of this line.

A straight line equation is $y = mx + c$ where m is the gradient and c is y intersect

Line passing through E has same gradient as line DF

Gradient = change y ÷ change x

Gradient = 2 ÷ 2 = 1
So m = 1

But it is a minus gradient
So m = -1

So equation is $y = mx + c$

intersects with y-axis at 1

So c = 1

$y = -1x + 1$ ✓
or $y = -x + 1$

.....

(4)

18. A door has a height of 2.2m correct to 2 significant figures.

a) For the height of the door what is

Bounds are to do with accuracy.

Upper Bound is the largest possible
Lower bound is the smallest possible

What is the largest height of the door before it is 2.3m to 2 sign. figs?

i) the upper bound

2.26m to 2 sf is 2.3 so the upper bound is just below this at 2.25m

2.25 ✓ ….m

ii) the lower bound

2.15m to 2 sf is 2.2 so the lower bound is 2.15m

2.15 ✓ ……m **(2)**

The door has an area of 3.59 m^2 correct to 3 significant figures.

b) i) Calculate the upper bound for the width of the door
Write down all the figures on your calculator display

Area = height x width. So width = area ÷ height

Width upper bound = Area upper bound ÷ Height lower bound

Area upper bound = 3.595 to 3 sf

Height lower bound = 2.15

Width upper bound = 3.595 ÷ 2.15

1.672093 ✓ **(2)**

19. a) Expand and simplify $(4a - 1)(4a + 1)$

$16a^2 - 1$ **(2)**

b) Expand and simplify $(3x + 6)(4x - 3)$

$12x^2 + 15x - 18$ **(2)**

c) Factorise $x^2 - 1$

$(x + 1)(x - 1)$ **(2)**

d) Factorise $29x - 6x^2 - 28$

$(3x - 4)(7 - 2x)$ **(2)**

e) Complete the square for $x^2 - 6x + 7$

$(x - 3)^2 - 2$ **(3)**

f) Hence solve $x^2 - 6x + 7 = 3$
Give your answer in surd form

$x = \sqrt{5} + 3$ or $x = -\sqrt{5} + 3$ **(2)**

20.

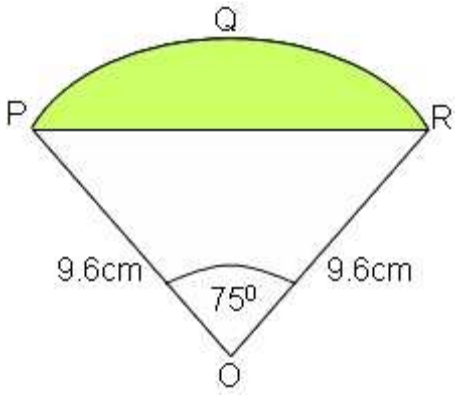


Diagram not drawn accurately

The diagram above shows a sector OPQR of a circle with centre O
PO = 9.6 cm
RO = 9.6 cm
Angle POR = 75^0

a) Calculate the length of the arc PQR of the sector
Give your answer correct to 3 significant figures

Circumference = π x 2xr

Circumference = π x 2 x 9.6cm
= 3.142 x 19.2
= 60.3185 cm

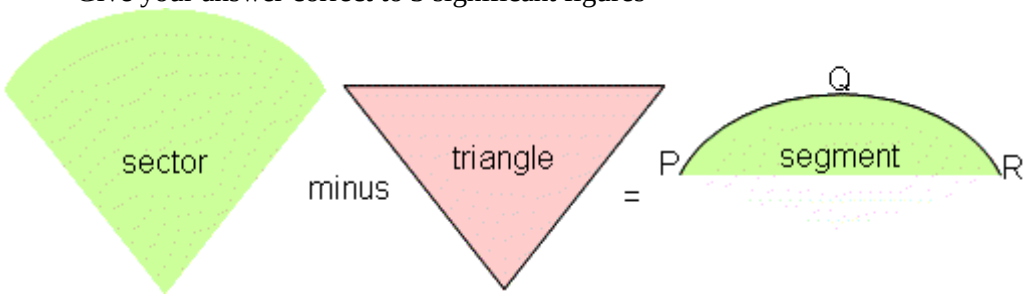
Arc PQR length can be calculated as a fraction of the circumference

Arc PQR length = $\frac{75}{360} \times C$

Arc PQR length = $\frac{75}{360} \times 60.3185 = 12.56$

12.6 .cm **(3)**

b) Calculate the area of the shaded segment PQR
Give your answer correct to 3 significant figures



Area circle = π r^2
= 3.142 x 9.6 x 9.6 cm^2
= 289.57cm^2

Sector is a fraction of the area

The fraction is 75/360 th

Sector area = $289.57 \times \frac{75}{360} = 60.33$

Triangle area = ½ a x b sine C

Δ area = ½ x 9.6 x 9.6 x sin 75

Δ area = 46.08 x 0.9659 = 44.51

Segment = 60.33 – 44.51 = 15.82

15.8 **(4)**

21. Solve this quadratic equation

$x^2 - 7x - 9 = 0$

Give your answer correct to 3 significant figures

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

a = 1, b = -7, c = -9

$$x = \frac{+7 \pm \sqrt{-7^2 - 4\_x\_1\_x\_-9}}{2 \times 1} = \frac{+7 \pm \sqrt{49+36}}{2} = \frac{+7 \pm \sqrt{85}}{2} = +7 \pm \frac{9.2195}{2}$$

x = (+ 7 + 9 .2195) ÷ 2

x = (+ 7 - 9 .2195) ÷ 2

(4)

$x =$ .. 8.11 or $x =$. -1.11

An alternative method is called completing the square.

22.

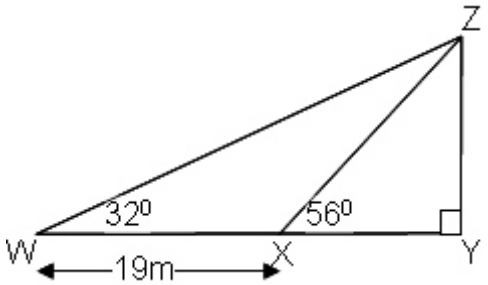
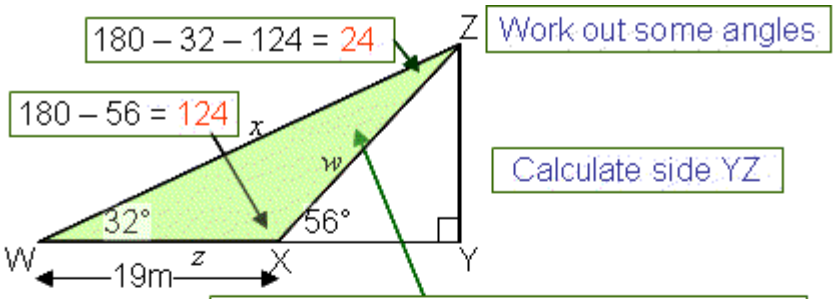
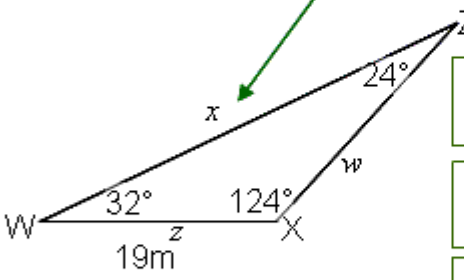


Diagram not accurately drawn

The diagram above shows two triangles.
Triangle XYZ is a right angled triangle with ZXY = 56^0
Triangle WXZ has side WX= 19m and XWZ = 32^0

Calculate YZ
Give your answer correct to 3 significant figures



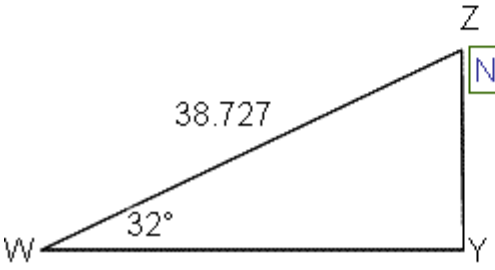


$$\frac{z}{\sin 24°} = \frac{x}{\sin 124°}$$

$$x = \frac{\sin 124° \times 19}{\sin 24°}$$

$x = 38.727$

sin 1 2 4 x 1 9 ÷ sin 2 4 =



Now use normal SOHCAHTOA

$$\sin 32° = \frac{YZ}{38.727}$$

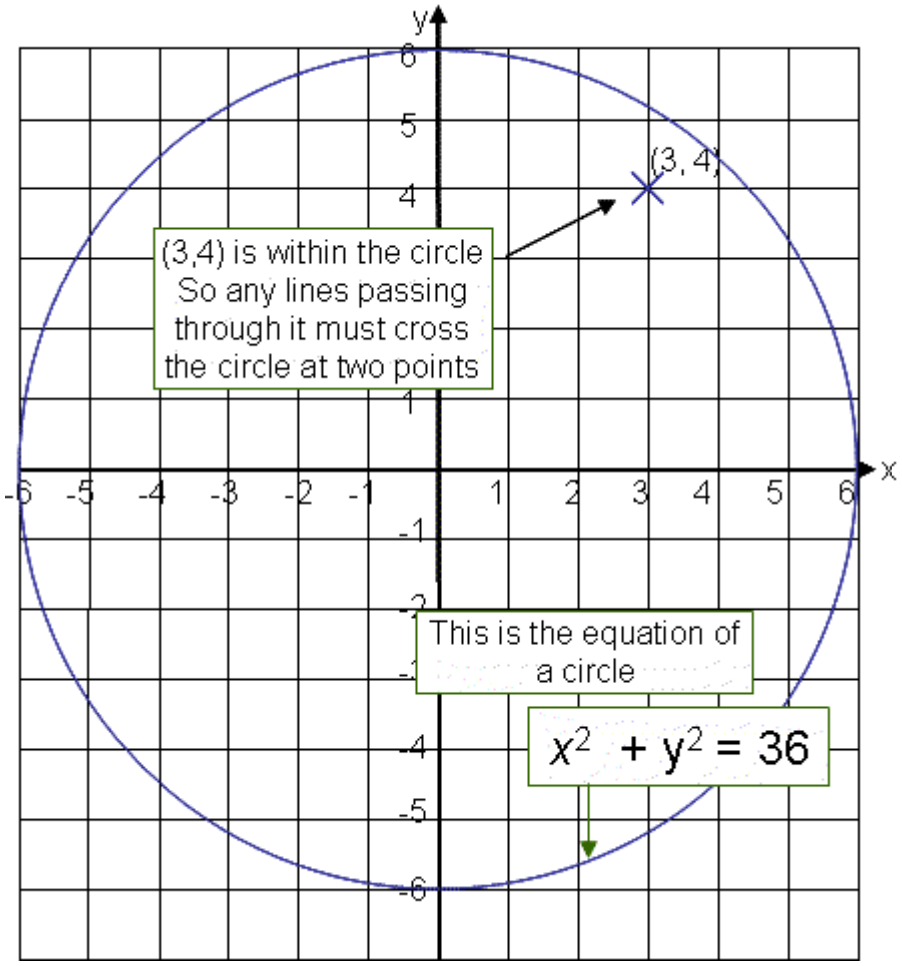
$YZ = \sin 32° \times 38.727$

sin 3 2 x 3 8 . 7 2 7 =

20.5 ✓

……m **(5)**

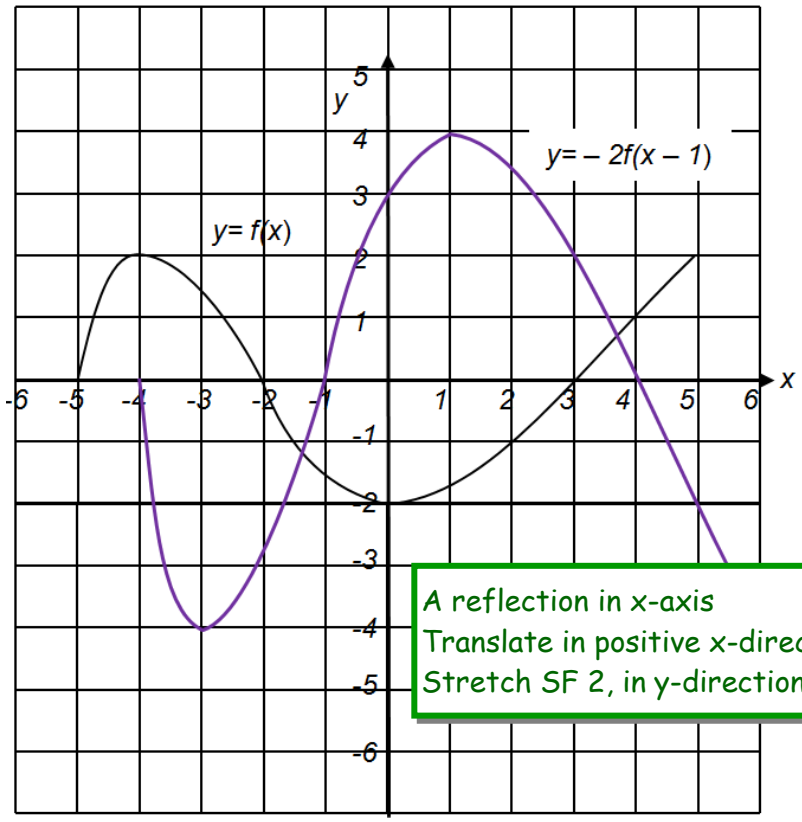
23.



$x^2 + y^2 = 36$ is the equation of a circle radius 6
Point (3, 4) is within the circle so any lines passing through this point must cross the circle in two places.

(3)

24. The graph of $y = f(x)$ is shown on the grid.



On this grid, sketch the graph of $y = -2f(x - 1)$

What are the co-ordinates of the highest point of $y = -2f(x+1)$

(3)

(... 1 , 4 ...)

(1)