MathsMadeEasy

GCSE Mathematics
Calculator
Higher Tier
Free Practice Set 4
1 hour 45 minutes

ANSWERS
Marks shown in brackets for each question (2)

A*	A	B	C	D	E
88	75	60	45	25	15

Legend used in answers

Green Box - Working out

> 5b means five times b
> b = − 3 so 5 × − 3 = −15
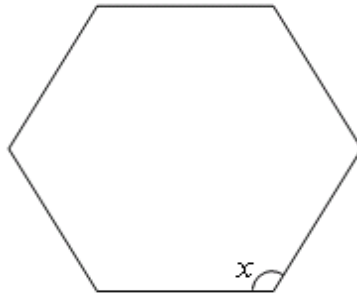
Red Box and ✓ - Answer

> **48 %** ✓

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) Calculate the size of an interior angle x of the regular shape below.
Show all your working

6 exterior angle : 360^0 ÷ 6 = 60

interior angle = 180^0 – exterior angle

120 ✓

$_0$ (2)

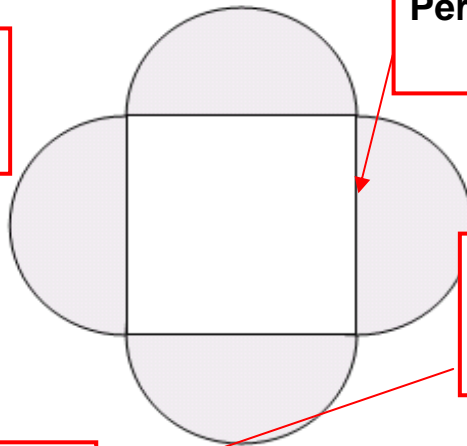b) The shape below is made by drawing semicircles on each of the sides of a square.

The perimeter of the square is 24 cm.

Calculate the shaded area.

**Perimeter square = 24cm
So side = 6cm**

**4 half circles so
2 whole circles in
total**

**Circle has diameter
= 6cm
So radius r = 3cm**

Area 1 circle = π r^2

**Area circle = π 3^2
= π x 9
= 28.278**

28.278 x 2 circles = 56.56

56.5 ✓

.cm^2 (4)

2. Joe made Spaghetti Bolognese for dinner.

Some of the ingredients he used are shown.

Some of the amounts are missing.

Calculate and write the missing amounts in the table

$$150 \div 6 \ \times 9$$

	For 6 people	For 9 people
mushrooms	150 gram	**225** ✔
minced beef	**600** ✔	900 grams
spaghetti	**750** ✔	1125 grams
chopped tomatoes	500 grams	**750** ✔

(3)

3. Stuart went to Australia
He exchanged some money at £1.00 for 1.52 Australian dollar

a)   What is £25 in Australian dollars.

Get more dollars per pound so multiply by 1.52

25 x 1.52 = 38

A$.................................... **38** ✔

(2)

b)   What is 55 Australian dollars in £s

Get less dollars per pound so divide by 1.52

55 ÷ 1.52 = 34.81

£... **36.18** ✔

(1)

4. Here is some information about the results of two tests.

	Test A	Test B
Number taking the test	80100	73250
Percentage getting top grade	22%	28%

How many more students gained top grade in Test B than in Test A?

80, 100 x 22% = 17622

73, 250 x 28% = 20510

20510 – 17622 = 2888

…….. **2888**

(3)

5. a) Use your calculator to work out:

$$\frac{51.4 \ - \ 4.9}{6.05 \ \times \ 0.31}$$

Write down the figures on your calculator display.

You must give your answer as a decimal.

(51.4 – 4.9) ÷ (6.05 x 0.31)

………. **24.793388**

(2)

6.   a)   Make x the subject of the formula

$$y = 3x - 6$$

y + 6 = 3x

$$\frac{y + 6}{3} = x$$

$x = ...$ $\dfrac{y + 6}{3}$ ✔

(2)

b)   Find all the possible values of p if

$$-2 \leq p < 5$$

–2 , –1 , 0, 1, 2, 3, 4 ✔

....

(2)

c)   Solve $5x - 20 = 2x + 16$

Take 2x off both sides gives: 3x – 20 = 16
Add 20 to both sides: 3x   = 36

12 ✔

....

(2)

d)   Make x the subject of the formula

$$y = 5x + yx - 7z$$

y + 7z   =   5x   +   yx
y + 7z   =   x(5 + y)
$$\frac{y + 7z}{5 + y}   =   x$$

$x = ...$ $\dfrac{y + 7z}{5 + y}$ ✔

(2)

7.   Look at the right angled triangle below**.**

Not drawn accurately
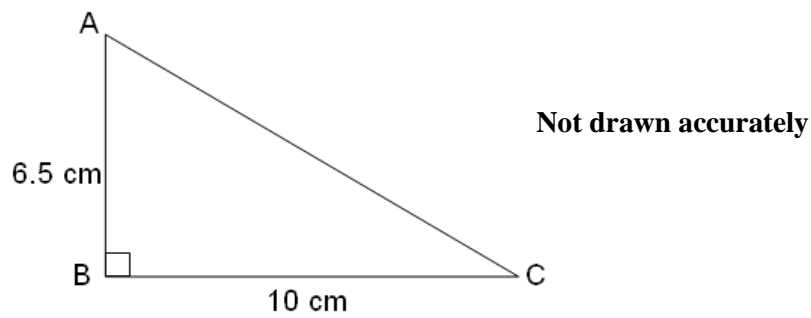
a)   Calculate the area of the triangle ABC.

10 x 6.5 = 65   Then halve it

32.5 ✓

.... cm^2 **(2)**

b)   Work out the length of side AC to 2 decimal places

Pythagoras theorem
Longest side ^{2} = 6.5^2 + 10^2
= 42.25 + 100
√142.25 = 11.926

11.93 ✓

.... cm   **(3)**

8. There are 120 coins in a money bag.

The table shows the probability for randomly picking different coins out of the bag

Coins	5p	10p	20p	50p	£1
Probability	0.2	0.1		0.35	0.05

a) What is the probability of picking a 20p coin

Probabilities add up to 1

1 − 0.2 − 0.1 − 0.35 − 0.05 = 0.3

✓

0.3 (1)

b) Calculate the total value of the money in the bag

coin	No.	value
5p: 0.2 x 120 =	24 →	£ 1.20
10p: 0.1 x 120 =	12 →	£ 1.20
20p: 0.3 x 120 =	36 →	£ 7.20
50p: 0.35 x 120 =	42 →	£21.00
£1: 0.05 x 120 =	6 →	£ 6.00
		£36.60

✓

£ **36.60** (3)

9. Look at this equation

$$x^3 - 5x = 30$$

The value for x is between 3 and 4

Use trial and improvement to find the value for x to one decimal place.

Show all your working. Use the table to help you.

x	x^3	$-5x$	$=$
3	27	− 15	12 low
4	64	− 20	44 high
3.5	42.88	− 17.5	25.4 low
3.6	46.66	− 18	28.66 low
3.7	50.65	− 18.5	32.15 high

28.66 is closer to 30 than 32.15 so x = 3.6

✓

3.6

x = ...

(4)

10. a) Solve

$$3x + 4y = 18$$
$$10x - 4y = 8$$

Add both equations:

13x	**=**	**26**
x	**=**	**2**

Sub x = 2 in top   **6 + 4y** **=** **18**

4y	**=**	**12**
y	**=**	**3**

$x =$ .... **2** ✓ .... $y =$ .... **3** ✓ .... **(2)**

b) i) Expand and simplify $6(x^2 - 7x) + 2(3x - 21)$

6x² – 42x   +   6x – 42
6x²   –   36x   –   42

Divide everything by 6, gives
x²   –   6x   –   7

.... **x² – 6x – 7** ✓ **(2)**

ii) Hence solve $6(x^2 - 7x) + 2(3x - 21) = 0$

Using above
x² – 6x – 7 = 0
(x – 7) (x + 1) = 0

$x =$ .... **7 or – 1** ✓ .... **(2)**

c) Expand $(2x^2y^3)^4$

$$(2x^2y^3) \times (2x^2y^3) \times (2x^2y^3) \times (2x^2y^3)$$

.... $16x^8y^{12}$ ✓ (2)

d) Factorise $y^2 - 1$

.... $(y + 1)(y - 1)$ ✓ (2)

11. a) Sylvia paid £4000 for a car which depreciates by 15% each year. Calculate what the car is worth at the end of two years.

***Depreciates* means it is going down in value by 15% each year**

End 1ˢᵗ year: 15% of 4000 = 400 + 200 = 600 value = £3400
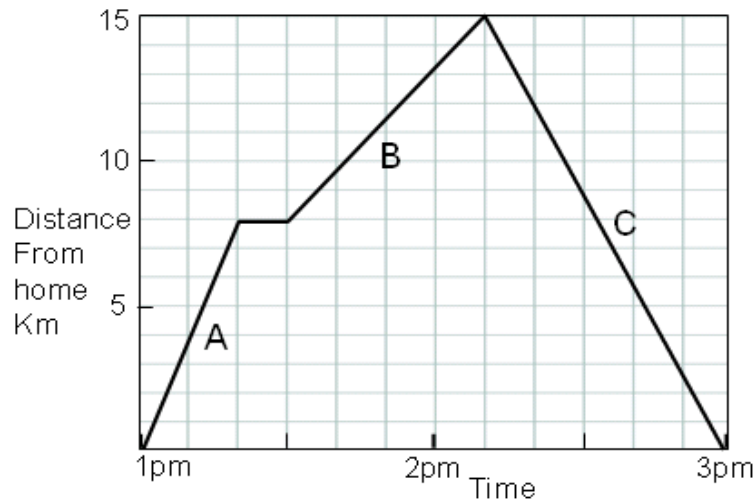**End 2ⁿᵈ year: 15% of 3400 = 340 + 170 = 510 value = £2890**

or... $0.85^2 \times 4000 = 2890$

£...... **2890** ✓ (2)

12.   Chantelle went for a ride on her BMX bike.

The distance-time graph shows how far away from home she was at different times.

Each division = 1/6 hour = 10 minutes

a)   Chantelle stopped on her ride.

    i)   What was the time when she stopped.
       Give your answer in terms of the 24 hour clock

13:20 ✔ (1)

How long did she stop for?

10 minutes ✔ (1)

b)   Calculate her speed for the different parts of her ride labelled A , B and C

> **A:**   **8 km in ⅓ hour so 24 km in 1 hour**
> **B:**   **7 km in ⅔ hour so 10.5 km in 1 hour**
> **C:**   **15 km in ⁵⁄₆ hour so 18 km in 1 hour**

A .... **24** ✔ km/hr

B .... **10.5** ✔ km/hr

C .... **18** ✔ km/hr

(3)

13. A line has the equation

$$y = 2x - 1$$

What is the gradient of the line that is perpendicular to this line

Take gradient of the line (2), flip it over (½) and change the sign

– ½ ✓ **(1)**

14. a) What is 0.0053 in standard form.

5.3 x 10^{-3} ✓ **(1)**

b) What is 7.563×10^6 as an ordinary number

7,563,000 ✓ **(1)**

c) Light travels at a speed of 3×10^8 metres per second

Assuming that there are 365 days in a year calculate how far light travels in a year. Give your answer in standard form in <u>kilometres</u>

Convert 1 year into seconds:

365 x 24 x 60 x 60 = 31536000 seconds
$$= 3.1536 \times 10^7$$
Distance travel in 1 year
$$= \quad 3.1536 \times 10^7 \times 3 \times 10^8 \text{ metres}$$

$$= \quad 9.4608 \times 10^{15} \text{ metres}$$
$$= \quad 9.4608 \times 10^{12} \text{ km}$$

Km... **9.4608 x 10^{12}** ✓ **(4)**

15.   A flag pole P is 4.6 m West of a scout hut H

A camp fire F, is 7.5m North of the flag pole P.

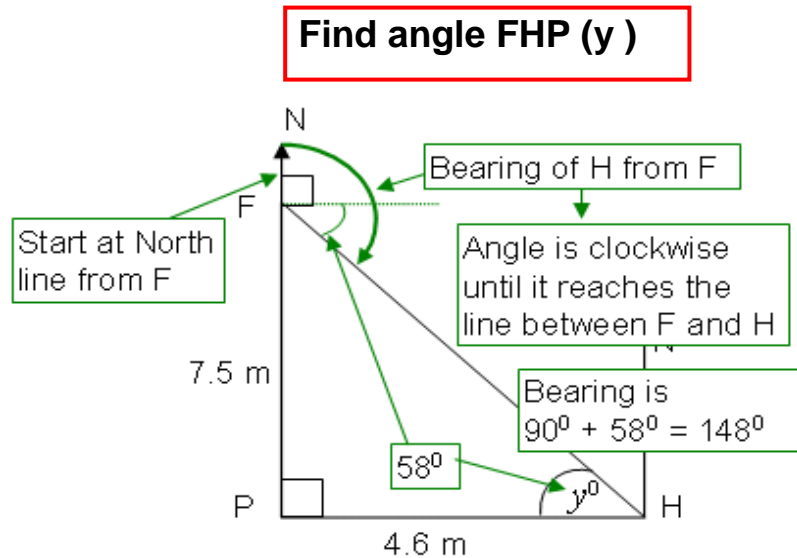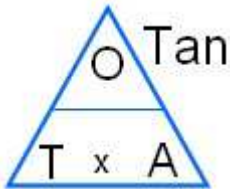Calculate the bearing of the scout hut from the camp fire to 2 significant figures

Find angle FHP (y)

Start at North line from F

Bearing of H from F

Angle is clockwise until it reaches the line between F and H

7.5 m

Bearing is $90^0 + 58^0 = 148^0$

58^0

P y^0 H

4.6 m

Diagram NOT drawn accurately

Tan angle	**=**	**Opposite side**
		Adjacent side

Tan y   **=** $\dfrac{7.5}{4.6}$ **= 1.6304**

Tan^{-1} 1.6304   **=**   **58.47^0 = 58 (2 sf)**

Bearing is clockwise from the north line until it reaches the line from F to H = 90 + 58 = 148^0

148 ^{0} **(3)**

....

16.

Label the sides of the triangle using the letters given. Side a is opposite angle A, Side b is opposite angle B and side c is opposite angle C
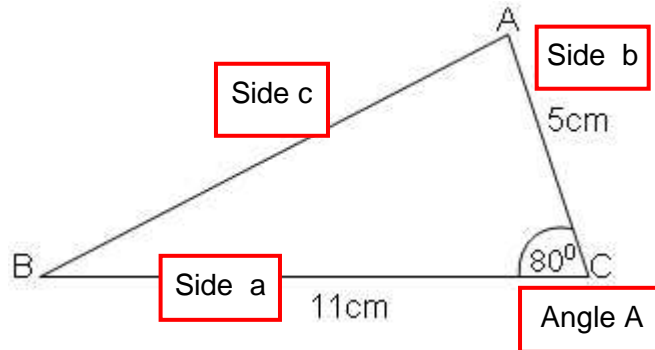
Side c

Side b

A

5cm

Diagram **NOT** drawn accurately

B

Side a

11cm

80° C

Angle A

ABC is a triangle.
BC = 11 cm
AC = 5 cm
Angle *ACB* = 80°

Calculate the area of the triangle.
Give your answer correct to 3 significant figures.

Area △   =   ½ a b Sin C
**   or   ½ × a × b × Sin C**
**   =   ½ × 11 × 5 × sin 80 = 27.08**

0 **.** **5** **x** **1** **1** **x** **5** **x** **Sin** **8** **0** **=**   27.08

½   a   b   C

27.1 ✓

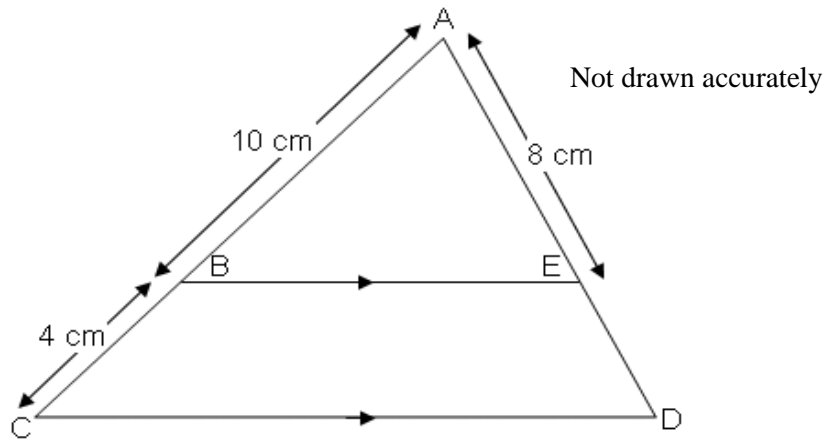.......................... cm^2 **(3)**

17. Lewis Hamilton drove 378 kilometres in 2 hours 15 minutes.

Calculate his average speed in km/h.

Convert 2hr 15min into a decimal
Speed = distance ÷ time = 378 ÷ 2.25

168 ✓

...............................km/h   **(2)**

18.

A

Not drawn accurately

10 cm

8 cm

B   E

4 cm

C   D

CD is parallel to BE
AB = 10cm, BC = 4cm, AE=8cm
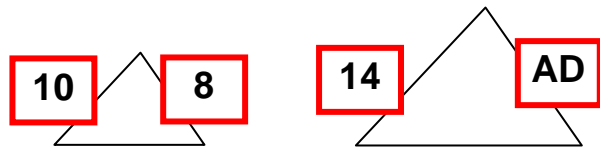
a)   Calculate the length of ED

| 10 | 8 | | 14 | AD |

These are similar triangles and we need to work out the scaling factor.
To make Δ larger, this is 1.4 (14÷ 10)
AD = 8 x 1.4   = 11.2
ED = AD – AE
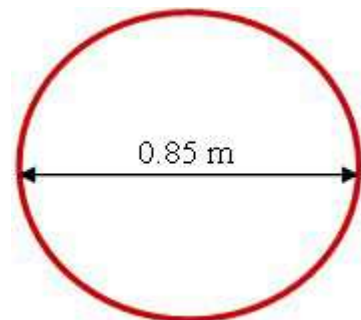**   =11.2 – 8   = 3.2 cm**

Or ratio of 10:4 is same as 8:ED
10:4 = 2.5 so 8:ED = 2.5 or ED = 8÷ 2.5 = 3.2

...... **3.2** ✓ cm   **(2)**

19.   The diameter of a hula hoop is 0.85 m

Diagram not
drawn accurately

a)   Calculate the circumference of the Hula Hoop
       Give your answer to 2 decimal places.

0.85 m

diameter = 0.85
Circumference = πd
π x 0.85

.... **2.67** ✓ ..m   **(2)**

20. There are 1200 pupils at St Georges Upper School.
The table shows information about the pupils.

Year	Boys	Girls
Year 7	187	200
Year 8	196	215
Year 9	195	207

Some students are carrying out a survey of pupils.
They use a stratified sample of 100 pupils.

a) Calculate how many girls should be sampled

Fraction of girls = 200 + 215 + 207 = $\dfrac{622}{1200}$

Girls to be samples is this fraction x 100 = 51.8

52 ✓

(2)

b) Calculate the number of boys in year 8 to be sampled.

Fraction of year 8 boys = $\dfrac{196}{1200}$ =

Year 8 boys to be samples is this fraction x 100 = 16.3

16 ✓

(2)

c) How many more year 9 girls than year 9 boys are in the stratified sample

Fraction of year 9 boys = $\dfrac{195}{1200}$ → 16

Fraction of year 9 girls = $\dfrac{207}{1200}$ → 17

1 ✓

(2)

21. Gaynor carries bags of carrots in her van.

Max load 1200 kg

30 kg

The van has a sign that says "maximum load 1200 kg.
Each bag of carrots weighs 30 kg.

Gaynor needs to keep within the safety weight limits of her van and she assumes that

1200kg is correct to the nearest 100kg
and 30kg is correct to 1 significant figure

a) What is the lower bound for the load of the van

What is lowest value of 1200 before it changes to 1100?

1150 (1)

b) What is the upper bound for a bag of carrots.

What is highest value of 30 before it changes to 40?

35 (1)

c) Hence calculate the greatest number of bags of potatoes that Gaynor can **safely** put into her van if her assumptions are correct.

To find the greatest number of bags we can carry *safely*, find the smallest weight (lower bound) that the van could carry and divide that by the largest weight (upper bound) of each bag
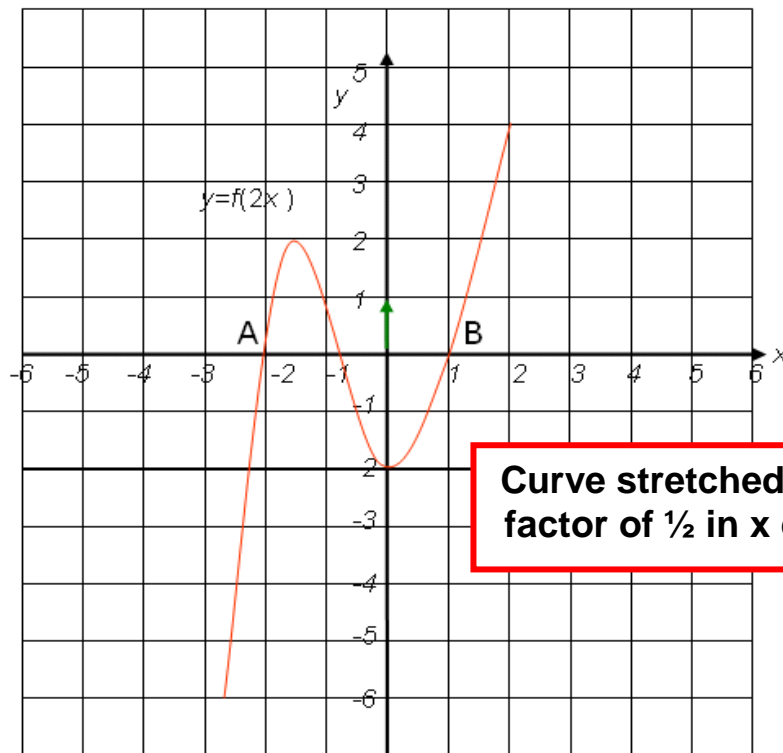
Greatest number bags = Van lower bound
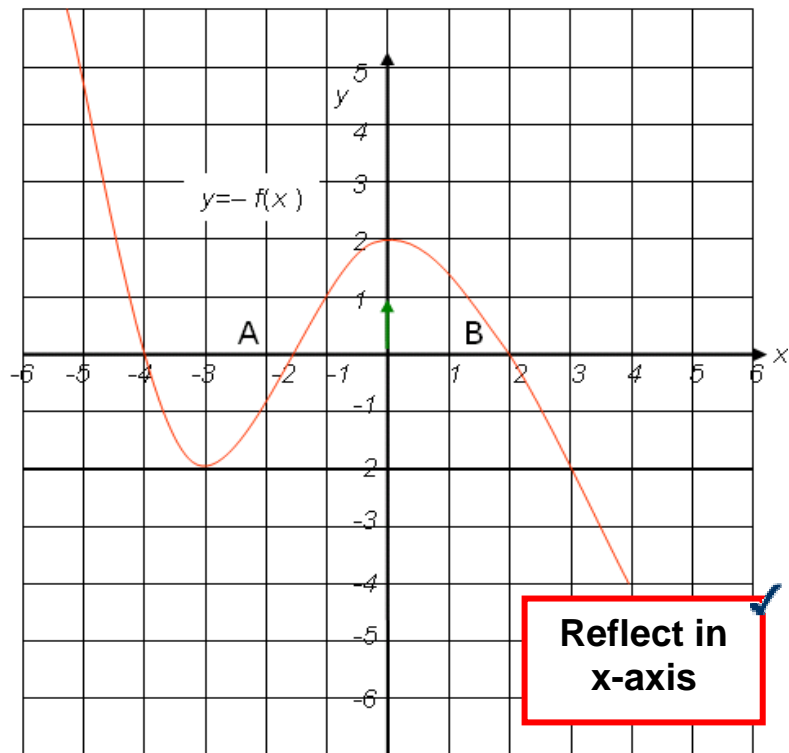   **Bag upper bound**

32 (3)

22. The graph of $y = f(x)$ is shown on the grids.

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

Curve stretched by scale factor of ½ in x direction ✓

(2)

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

Reflect in x-axis ✓

(2)

23.
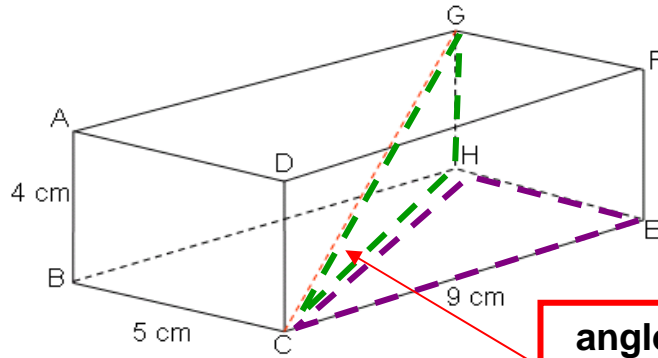
Diagram **NOT** accurately drawn

angle required is GCH

A cuboid ABCDEFGH is shown with

AB = 4 cm.
BC = 5 cm.
CE = 9 cm.

a) Calculate the length of CG.
Give your answer correct to 3 significant figures.

Work out the length of CH using Pythagoras on the base triangle CHE

$$CH^2 = CE^2 + HE^2 = 81 + 25 = 106$$

Work out the length of CG using Pythagoras on the vertical triangle CHG

$$CG^2 = CH^2 + HG^2 = 106 + 16 = 122$$

11.0 ✓
.... cm   **(3)**

b) Calculate the size of the angle between CG and the face BCEH.
Give your answer correct to 1 decimal place.

angle required is GCH

Sine GHC = $\dfrac{GH}{CG} = \dfrac{4}{\sqrt{122}}$

Use Sin $^{-1}$ to convert to an angle

21.2 ✓
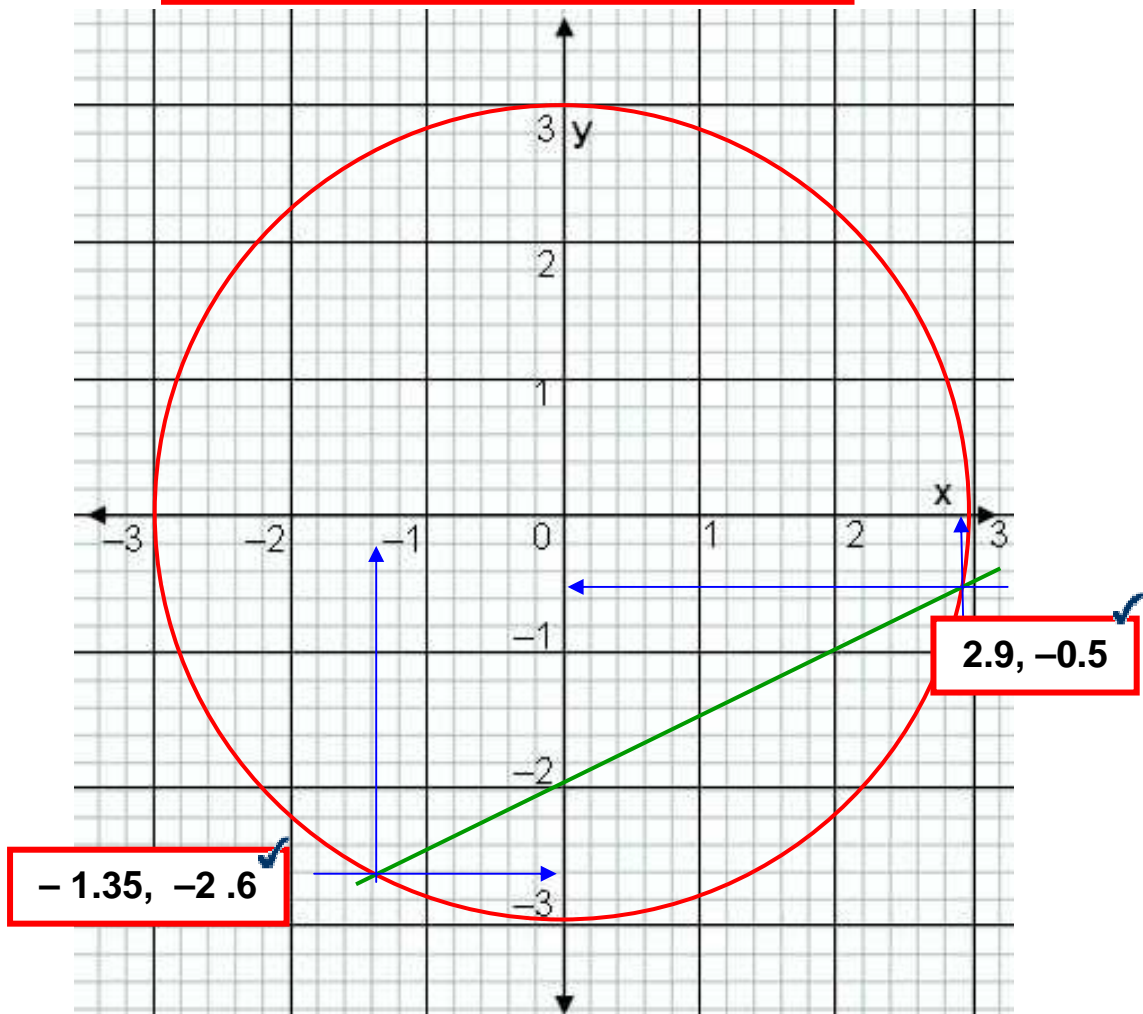.......................° **(2)**

24. Draw the graphs for these simultaneous equations and use them to find the solutions

$$x^2 + y^2 = 9$$
$$y = \tfrac{1}{2}x - 2$$

$x^2 + y^2 = 9$ is a circle centre 0,0 and radius 3

$y = \tfrac{1}{2}x - 2$ is a straight line gradient $\tfrac{1}{2}$ with intercept -2

2.9, –0.5 ✓

– 1.35, –2 .6 ✓

The solutions are where they intersect.

x…… **2.9** ✓ . and … **– 1.35** ✓
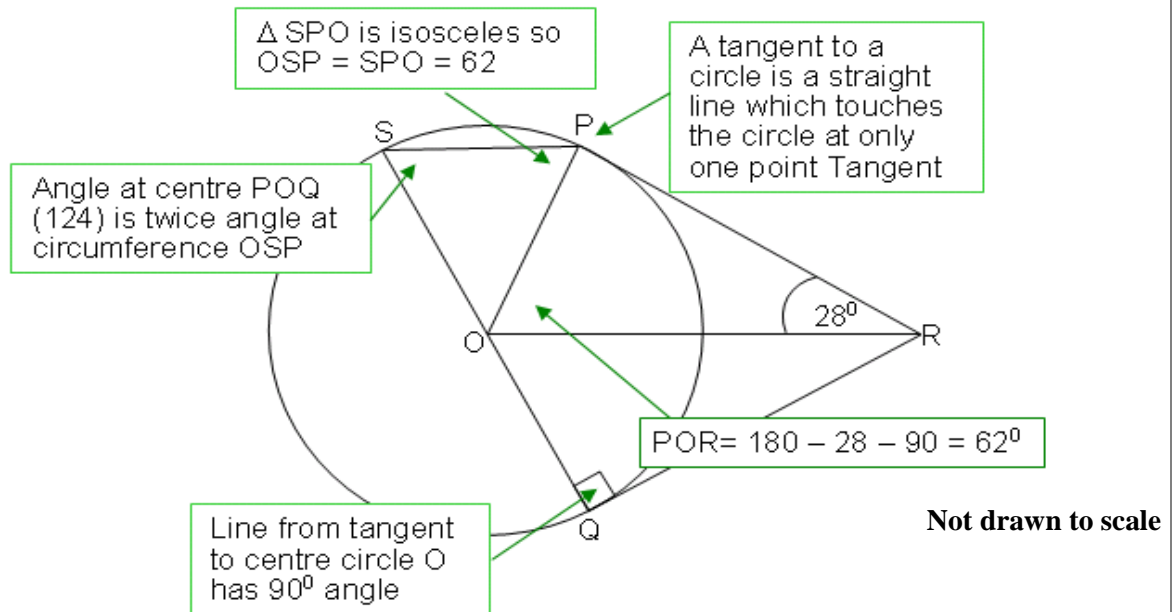
y…… **– 0.5** ✓ .and …… **– 2.6** ✓

(3)

25. Two tangents meet a circle centre O at P and Q.

SQ is the diameter of the circle.

Angle ORP = 28^0

Work out the value of angle SPO

△ SPO is isosceles so
OSP = SPO = 62

A tangent to a
circle is a straight
line which touches
the circle at only
one point Tangent

Angle at centre POQ
(124) is twice angle at
circumference OSP

28^0

POR= 180 – 28 – 90 = 62^0

Not drawn to scale

Line from tangent
to centre circle O
has 90^0 angle

62

SPO .... ^{0} **(3)**

Explain how you got your answer

Line from tangent to centre circle = 90
Angle at centre is twice angle at circumference
SOP is isosceles