# GCSE Mathematics

# Practice Tests: Set 9

## Paper 3H (Calculator)

### Time: 1 hour 30 minutes

You should have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

**Instructions**

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

- **Calculators may be used.**
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

**Information**

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

**Advice**

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

**1**   (a)  Work out the value of $\left(\dfrac{125.6}{4.7}\right)^2$

Write down all the figures on your calculator display.

.................... **714.140335** ....................

**(2)**

(b)  Write your answer to part (a) correct to 3 significant figures.

.................... **714** ....................

**(1)**

**(Total for Question 1 is 3 marks)**

**2**   Helga has played a game many times.

*Relative Frequency*

She scored 9 or more in $\dfrac{5}{6}$ of these games.

Helga is going to play the game another 60 times.

Work out an estimate for the number of times she will score 9 or more in these 60 games.

*Relative Frequency*
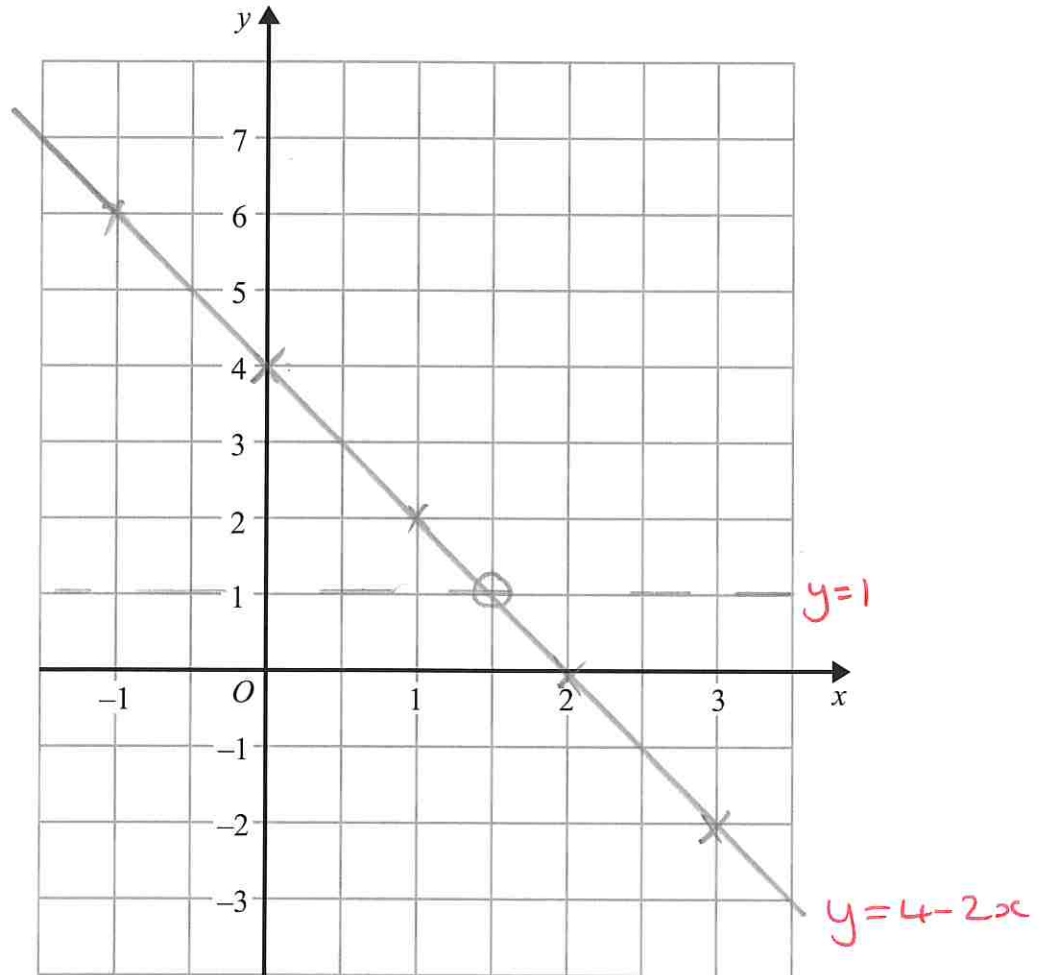
$60 \times \dfrac{5}{6}$

$= 50$

.................... **50** ....................

**(Total for Question 2 is 2 marks)**

**3** (*a*) On the grid, draw the graph of $y = 4 - 2x$ for values of $x$ from $-1$ to $3$.

| $x$ | $-1$ | $0$ | $1$ | $2$ | $3$ |
|---|---|---|---|---|---|
| $y$ | $6$ | $4$ | $2$ | $0$ | $-2$ |



$y = 1$

$y = 4 - 2x$

(3)

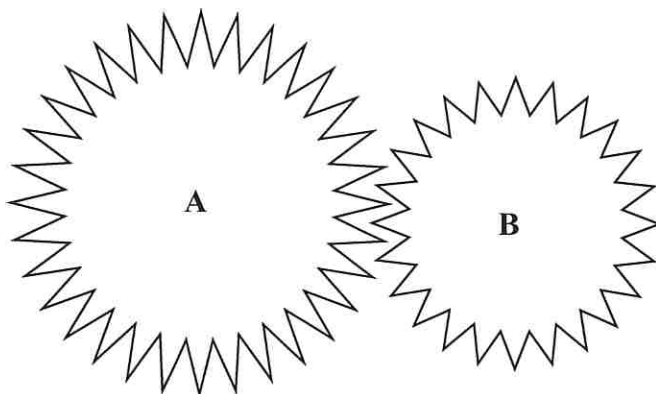(*b*) Write down the coordinates of the point where the graph of $y = 4 - 2x$ crosses the line $y = 1$

(...........1·5........., ...........1...........)

(1)

**(Total for Question 3 is 4 marks)**

4    The diagram shows two cogs, **A** and **B**.



There are 32 teeth on cog **A**.
There are 24 teeth on cog **B**.

The two cogs both rotate.
Cog **A** completes 12 full turns while cog **B** completes 16 full turns.

Work out the number of full turns that cog **A** completes while cog **B** completes 60 full turns.

cog A :  cog B

12  :  16

×3.75 ↓        x  :  60       ↑ ÷3.75        60 ÷ 16 = 3.75

x = 45

...................................45...................................

**(Total for Question 4 is 2 marks)**

5     The size of each exterior angle of a regular polygon is 24°

(a)   Work out the number of sides of the polygon.

Sum of exteriors
= 360°

(÷24)

$24n = 360$
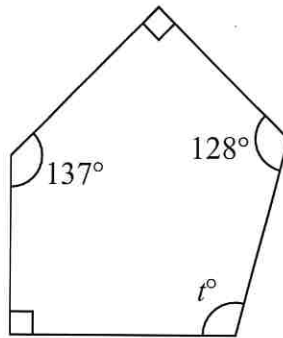
$n = 15$

15

(2)

Here is a pentagon.

137°  128°  90°  $t°$

Diagram **NOT**
accurately drawn

(b)   Work out the value of $t$.

Sum of interior
angles of a pentagon

(-445)

$(5-2) \times 180° = 540°$

$137° + 128° + 90° + 90° + t° = 540°$

$445°$

$+ t° = 540°$

$t = 95°$

$95°$

(3)

**(Total for Question 5 is 5 marks)**

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**6** Marta breeds dogs.

32 dogs give birth to puppies.

The table shows information about the number of puppies born to each dog.

| Number of puppies | Frequency | | midpoint | fm |
|---|---|---|---|---|
| 1 – 3 | 5 | | 2 | 10 |
| 4 – 6 | 12 | | 5 | 60 |
| 7 – 9 | 10 | | 8 | 80 |
| 10 – 12 | 4 | | 11 | 44 |
| 13 – 15 | 1 | | 14 | 14 |

TOTALS   $\Sigma f = 32$      $\Sigma fm = 208$

(*a*) Write down the modal class.

MOST FREQUENT

...................... 4 – 6 ......................

**(1)**

(*b*) Work out an estimate for the mean number of puppies born to each dog.

Estimate for the mean $= \dfrac{\Sigma fm}{\Sigma f}$

$= \dfrac{208}{32}$

$= 6.5$

...................... 6.5 ......................

**(4)**

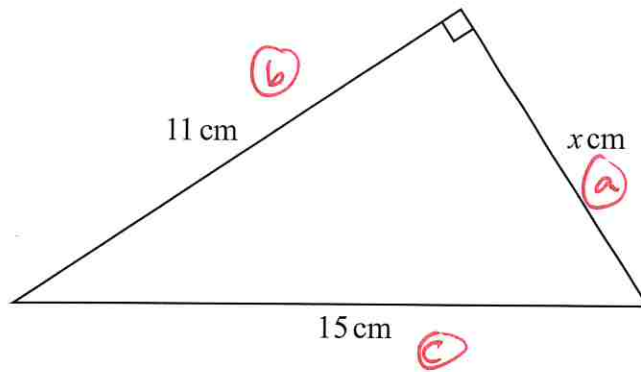**(Total for Question 6 is 5 marks)**

**7**

11 cm

*x* cm

15 cm

Diagram **NOT**
accurately drawn

Work out the value of *x*.
Give your answer correct to 3 significant figures.

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

$x^2 + 11^2 = 15^2$

$x^2 + 121 = 225$

(−121) | $x^2 = 104$

$\sqrt{ANS}$ | $x = 10.2$ cm (3 s.f.)

..................**10.2cm**..................

**(Total for Question 7 is 3 marks)**

**8** The line **L** has equation $4x + 5y = 20$

(a) Work out the gradient of **L**.

NEED: $y = mx + c$

$(-4x)$
$(\div 5)$

gradient

$4x + 5y = 20$

$5y = 20 - 4x$

$y = 4 - \frac{4}{5}x$

$m = -\frac{4}{5}$

.................................$-\frac{4}{5}$.................................

(2)

The line **M** has gradient 2.
**L** and **M** both cross the $y$-axis at the same point.

(b) Find an equation for **M**.

NOTE

$*$ ALSO INTERCEPT FROM PART (A) = 4 $*$

L:    $4x + 5y = 20$

at $y$-axis, $x = 0$    $4(0) + 5y = 20$

$(\div 5)$      $5y = 20$

$y = 4$

∴ crosses $y$-axis at $(0, 4)$

M:    $y = 2x + c$

$c = 4$ since
same intercept as L    $y = 2x + 4$

.................$y = 2x + 4$.................
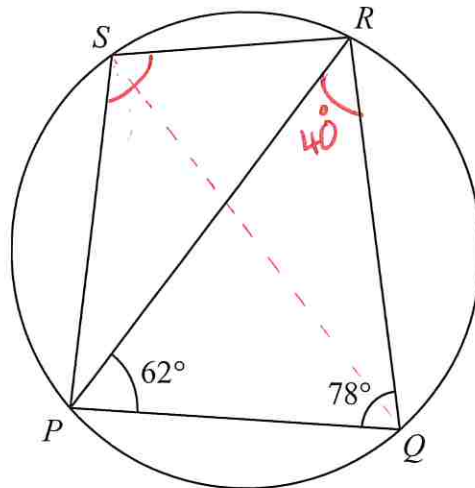
(2)

**(Total for Question 8 is 4 marks)**

**9**



Diagram **NOT** accurately drawn

$P$, $Q$, $R$ and $S$ are points on a circle.
Angle $RPQ = 62°$ and angle $PQR = 78°$

(a) (i) Find the size of angle $PSR$.

$180 - 78 = 102°$

................................ 102 °

(ii) Give a reason for your answer.

...... opposite angles in a cyclic quadrilateral are equal. ......

**(2)**

(b) Work out the size of angle $PSQ$.

$\hat{PRQ} = 180° - 62° - 78°$
$\quad = 40°$

$\hat{PSQ} = 40°$

Angles in a $\triangle = 180°$

Same segment theorem

................................ 40 °

**(2)**

**(Total for Question 9 is 4 marks)**

10    The cumulative frequency graph shows information about the number of calories used by 88 people during their exercise programme at a sports centre.
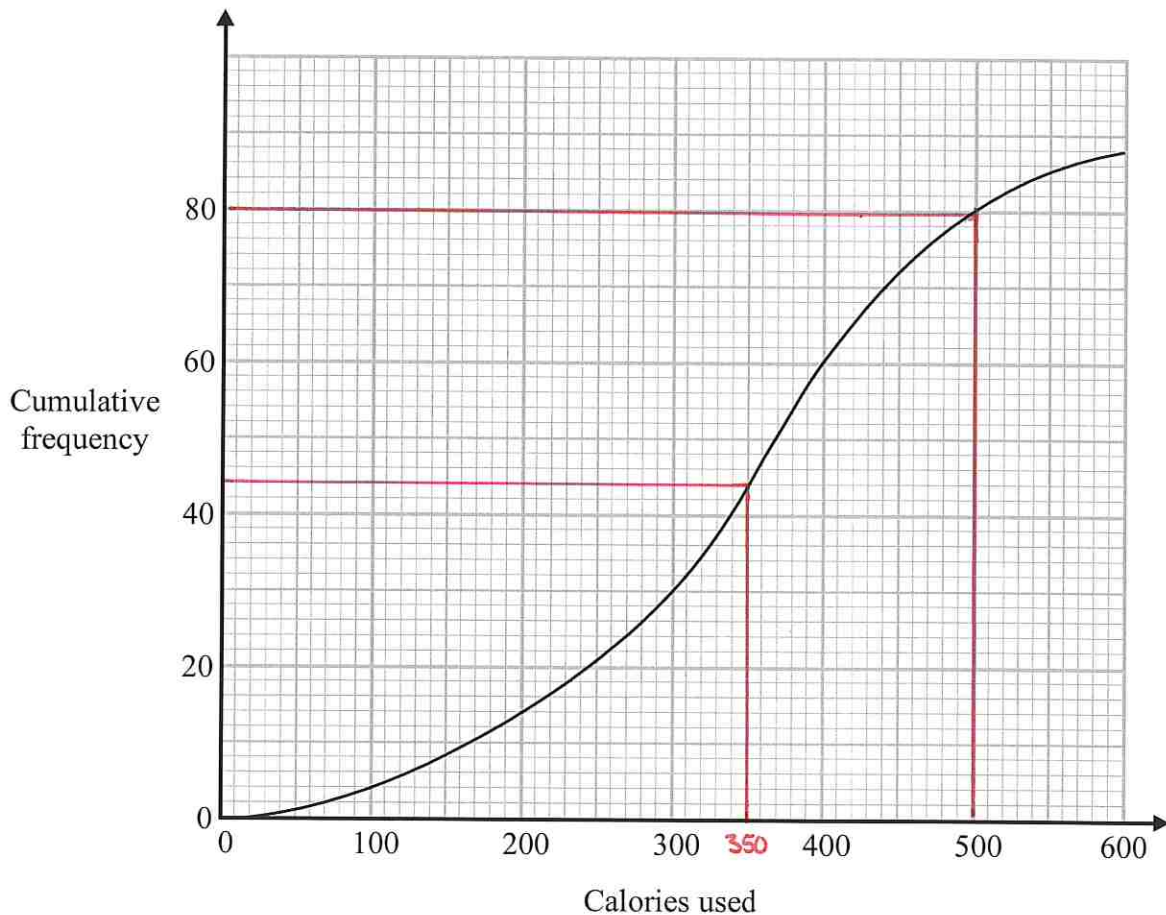


(a)   Use the graph to find an estimate for the median number of calories used.

$$\text{median} = \frac{n}{2} = \frac{88}{2} = 44^{th} \text{ term}$$

$$= 350 \text{ calories}$$

.................................................. **350** .... calories

(2)

(b)   Use the graph to find an estimate for the number of these 88 people who used more than 500 calories.

80 people up until 500 calories

$$88 - 80 = 8$$

.................................................. **8** ..........

(2)

**(Total for Question 10 is 4 marks)**

**11** *(a)* Solve the inequality $\frac{1}{4}p < 7$

$$\frac{1}{4}P < 7$$

$(\times 4)$  $\quad P < 28$

$$P < 28$$

**(1)**

*(b)* Solve the inequality $16q^2 > 9$

Solving Quadratic Inequalities

$$16q^2 > 9$$

$(\div 16)$  $\quad q^2 > \frac{9}{16}$

$(-\frac{9}{16})$  $\quad q^2 - \frac{9}{16} > 0$

Sketch  $\quad (q + \frac{3}{4})(q - \frac{3}{4}) > 0$



$(-3/4, 0)$  $(3/4, 0)$
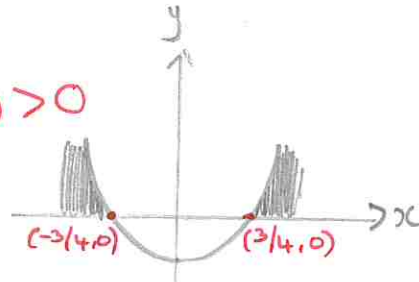
WHERE IS THE FUNCTION GREATER THAN 0?

$x > \frac{3}{4}$ and $x < -\frac{3}{4}$

$$x > \frac{3}{4}, \quad x < -\frac{3}{4}$$

**(3)**

**(Total for Question 11 is 4 marks)**

**12** Cylinder **A** has height 12 cm and diameter 8 cm.

(*a*) Work out the volume of cylinder **A**.
Give your answer correct to 3 significant figures.

$V = CSA \times h$

$CSA = \pi r^2 \quad (r = 8 \div 2) \quad CSA = \pi(4)^2 = 16\pi$

$V = CSA \times h \qquad V = 16\pi \times 12 = 603 \ (3sf)$

...............**603**............... cm³

**(2)**

Cylinder **B** is similar to cylinder **A**.
The height of cylinder **B** is 21 cm.

LSF   ASF   VSF
(Similar Shapes)

(*b*) Work out the diameter of cylinder **B**.

Height SF
A : B

∴ length SF = $\frac{7}{4}$
length A = 8

$\div 12 \downarrow \begin{array}{c} 12 : 21 \\ 1 : \frac{7}{4} \end{array} \downarrow \div 12$

$\times 8 \downarrow \quad \underline{8 : 14} \quad \downarrow \times 8$

...............**14**............... cm

**(2)**

Cylinder **C** is similar to cylinder **A**.
The volume of cylinder **C** is 64 times the volume of cylinder **A**.

(*c*) Work out the height of cylinder **C**.

LSF   ASF   VSF

$VSF = 64$

$LSF = \sqrt[3]{VSF} \ =$

height of A = 12

A : C
1 : 64
1 : 4
$\times 12 \downarrow \qquad \downarrow \times 12$
$\underline{12 : 48}$

...............**48**............... cm

**(3)**

**(Total for Question 12 is 7 marks)**

**13** Daniel buys a new car.
In the first year, the value of the car decreases by 24% of its original value.
The value of the car at the end of the first year is £13 300.

(*a*) Work out the original value of the car.

$$100\% - 24\% = 76\%$$

$$76\% \qquad = £13300$$

$(\div 76) \qquad 1\% \qquad = £175$

$(\times 100) \qquad 100\% \qquad = £17500$

£ ...........17500...........

**(3)**

The value of the car at the end of the first year is £13 300.

In each of the second year, the third year and the fourth year, the value of the car decreases by *x*% of its value at the beginning of each year.

The value of the car at the end of the fourth year is £6500. *Repeated Percentage Change*

(*b*) Work out the value of *x*.
Give your answer correct to 3 significant figures.

Start × multiplier$^t$ = End

multiplier = $1 + x\%$

$$13300 \times (1 + x)^3 = 6500$$

$(\div 13300)$

$$(1 + x)^3 = \frac{6500}{13300}$$

$$(1 + x)^3 = 0.4887\ldots$$

$\sqrt[3]{\text{ANS}}$

$$1 + x\% = 0.7876\ldots$$

$(-1)$

$$x\% = -0.212\ldots$$

$(\times 100)$

$$x = -21.2 \ (3\text{s.f})$$

conclusion

∴ <u>Decrease</u> by 21.2%

*x* = ..........21.2..........

**(3)**

**(Total for Question 13 is 6 marks)**

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13

**14** Two fair 6-sided dice are thrown.
The total is the sum of the numbers that each dice lands on.

(a) Work out the probability that the total is 4.

4 can be obtained by: $(1,3), (3,1) (2,2)$

$P(1,3) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

$P(3,1) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

$P(2,2) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$

Total $= \frac{3}{36}$

$\frac{3}{36}$

(2)

Three people each throw the two dice.

(b) Work out the probability that none of the three people get a total of 4.

$P(\text{Total of } 4) = \frac{3}{36}$

$P(\text{NOT Total of } 4) = 1 - \frac{3}{36} = \frac{33}{36}$

$P(\text{All } 3 = \text{NOT } 4) = P(\text{NOT } 4, \text{NOT } 4, \text{NOT } 4)$

$= \frac{33}{36} \times \frac{33}{36} \times \frac{33}{36}$

$= 0.770254629$

0.770254629

(2)

**(Total for Question 14 is 4 marks)**
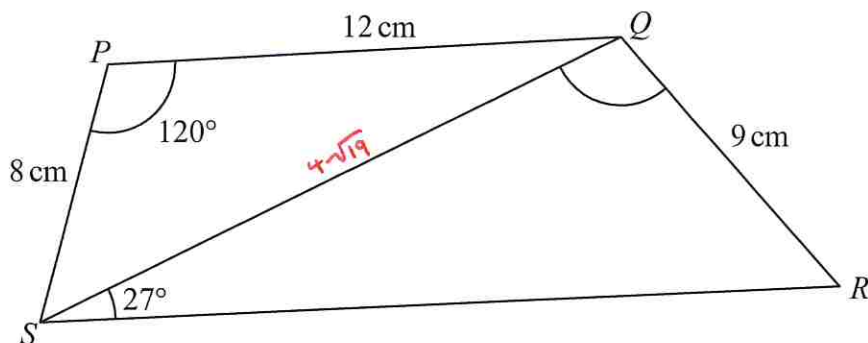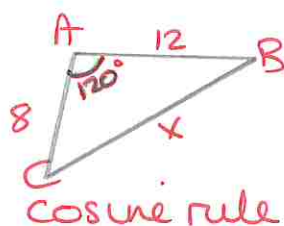
15 Here is a quadrilateral *PQRS*.



Diagram **NOT** accurately drawn

Angle *SRQ* is acute.

Work out the size of angle *SQR*.
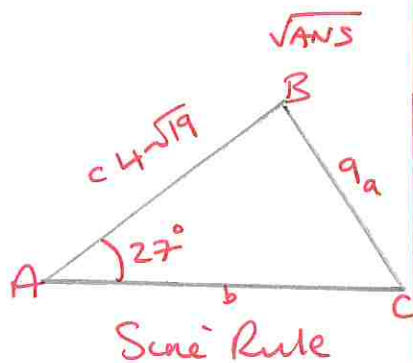Give your answer correct to 1 decimal place.



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$x^2 = (12)^2 + (8)^2 - 2(12)(8) \cos(120)$$

$$x^2 = 304$$

$$x = 4\sqrt{19}$$

$$\frac{\sin A}{a} = \frac{\sin C}{c}$$

$$\frac{\sin 27}{9} = \frac{\sin \theta}{4\sqrt{19}}$$

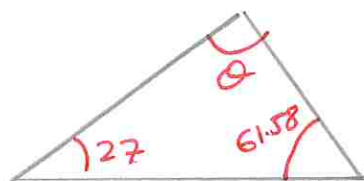$$\frac{\sin 27}{9} \times 4\sqrt{19} = \sin \theta$$

$$61.58\ldots = \theta$$

$$27 + 61.58\ldots + S\hat{Q}R = 180°$$

$$S\hat{Q}R = 91.4°\ (1d.p)$$

.................. **91.4** .................. °

**(Total for Question 15 is 6 marks)**

**16**   Solve the simultaneous equations

$$y = 5x^2 \quad ①$$
$$y - 4 = 3x \quad ②$$

Show your working clearly.
Give your solutions correct to 2 decimal places.

② :

(+4)

Put $y = 3x + 4$ in ① :

(−3x)

(−4)

factorise...

Quadratic formula
$a = 5$
$b = -3$
$c = -4$

$y - 4 = 3x$

$y \qquad = 3x + 4$

$3x + 4 = 5x^2$

$4 = 5x^2 - 3x$

$0 = 5x^2 - 3x - 4$

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

$x \qquad = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(-4)}}{2(5)}$

$x \qquad = 1.24 \ (2d.p) \ OR \ x = -0.64 \ (2d.p)$

$1.24 \ or \ -0.64$

........................................................................................................

**(Total for Question 16 is 4 marks)**

**17** Show that $\dfrac{\sqrt{50} - \sqrt{18}}{4}$ can be written in the form $\dfrac{1}{\sqrt{k}}$ where $k$ is an integer.

Show your working clearly.

$\sqrt{50} = \sqrt{25}\sqrt{2}$

$\sqrt{18} = \sqrt{9}\sqrt{2}$

Unrationalise... $\left( \times \dfrac{\sqrt{2}}{\sqrt{2}} \right)$

$\dfrac{\sqrt{50} - \sqrt{18}}{4}$

$= \dfrac{5\sqrt{2} - 3\sqrt{2}}{4}$

$= \dfrac{2\sqrt{2}}{4}$

$= \dfrac{\sqrt{2}}{2}$

$= \dfrac{\sqrt{2}}{2} \times \dfrac{\sqrt{2}}{\sqrt{2}}$

$= \dfrac{2}{2\sqrt{2}}$

$= \dfrac{1}{\sqrt{2}}$

**(Total for Question 17 is 3 marks)**

**18**

C

105°

7 cm            10 cm

A                        B
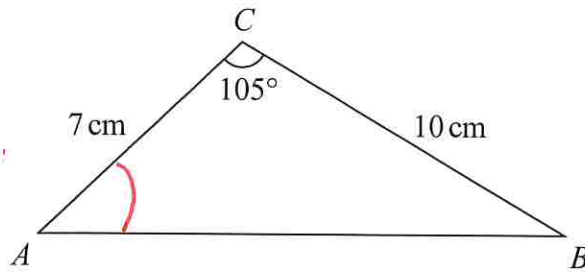
Diagram **NOT** accurately drawn

(a) Work out the area of triangle ABC.
Give your answer correct to 3 significant figures.

$A = \frac{1}{2}ab\sin C$

$A = \frac{1}{2}(7)(10)\sin(105)$
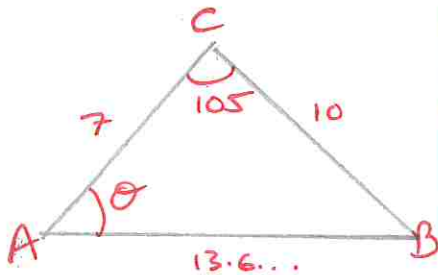
$= 33.8 \ (3s.f)$

.................... 33.8 .................... cm²

**(2)**

(b) Work out the size of angle BAC.
Give your answer correct to 1 decimal place.

cosine Rule
Need a pair of sides/
angles to use sine later!

$\sqrt{ANS}$

C

7    105    10

$\theta$

A                    B
13.6...

Sine Rule
(×10)

*shift sin*

$a^2 \neq b^2 + c^2 - 2bc \cos A$

$a^2 = (7)^2 + (10)^2 - 2(7)(10)\cos(105)$

$a^2 = 185.2...$

$a = 13.6...$

$\dfrac{\sin A}{a} = \dfrac{\sin C}{c}$

$\dfrac{\sin\theta}{10} = \dfrac{\sin 105}{13.6...}$

$\sin\theta = \dfrac{\sin 105}{13.6...} \times 10$

$\theta = 45.2 \ (1d.p)$

.................................... °

<div align="right">

**(5)**

**(Total for Question 18 is 7 marks)**

</div>

**19**   Simplify fully   $\dfrac{12x^2 - 3}{6x^2 + 5x - 4}$

*Simplifying Algebraic Fractions*

factorise top      $3(4x^2 - 1)$

factorise bottom   $(3x + 4)(2x - 1)$

WAIT... the top isn't finished!

$\underbrace{3(4x^2 - 1)}_{\text{Difference of two squares}} = 3(2x + 1)(2x - 1)$

Simplify

$$\dfrac{3(2x+1)\cancel{(2x-1)}}{(3x+4)\cancel{(2x-1)}}$$

$$= \dfrac{3(2x+1)}{3x+4}$$

$$\dfrac{3(2x+1)}{3x+4}.$$

.........................................

**(Total for Question 19 is 3 marks)**

**TOTAL FOR PAPER IS 80 MARKS**