

GCSE Mathematics

Practice Tests: Set 1

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.

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

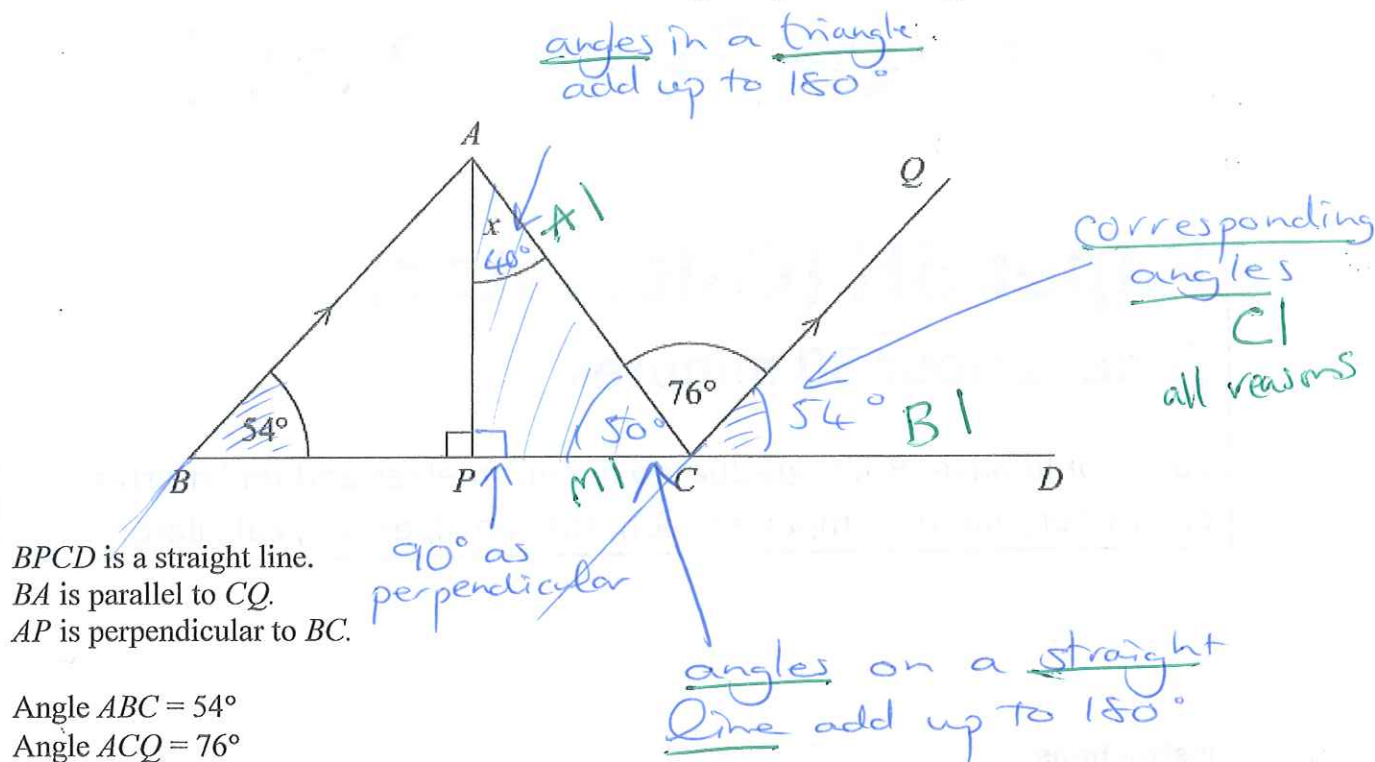
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1.



Work out the size of the angle marked x .
Give reasons for your answer.

$$\underline{\underline{x = 40^\circ}}$$

(Total 4 marks)

2. Jenny is organising a party.
She buys some paper plates and some plastic cups.

Paper plates are sold in packs.
There are 25 plates in a pack.
Each pack costs 78p.

25 78p

Plastic cups are sold in packs.
There are 35 cups in a pack.
Each pack costs £1.10

35 £1.10

Jenny buys exactly the same number of plates and cups.

What is the least amount of money she pays?

<u>Plates</u>	<u>Cups</u>
25	35
50	70
75	105
100	140
125	175
150	210
175	245

MI
(at least
3 of each)

175 * A1

5 packs
cups

7 packs
plates MI (either)

Least amount 175 of each

$$\text{Cost} = 7 \times £0.78 \text{ MI} \\ + 5 \times £1.10$$

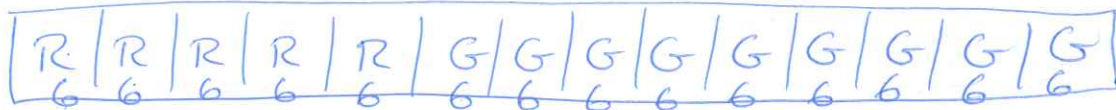
$$= \underline{\underline{£10.96 \text{ A1}}}$$

£

(Total 5 marks)

3. There are only red beads and green beads in a bag. R : G
The ratio of the number of red beads to the number of green beads is 5 : 9

(a) What fraction of the beads are red?



$$\frac{5}{14} \text{ BI} \dots\dots\dots (1)$$

There is a total of 84 beads in the bag.

(b) How many of the beads are green?

M $\left(\frac{9}{14} \right)$ of 84 = 54 AI

(3)

Susie is going to put some more beads in the bag.
There will still be only red beads and green beads in the bag.

Susie wants to have twice as many green beads as red beads in the bag.

(c) What beads should she put in the bag?
You must explain your answer.

R : G

30 : 54 MI

Add 6 AI more green beads to give
30 Red and 60 green. CI

(3)

(Total 7 marks)

4. The table shows some information about the average adult spending in 2008 as a percentage of average total adult spending in 2008.

Item	Percentage
food	11%
housing	11%
leisure	13%
clothes	5%
transport	14%
household goods	8%
other items	38%

In May 2008, Katie spent a total of £425.

She spent £48.45 of the £425 on food.

Compare the percentage that Katie spent on food with the average adult spending on food.

$$\text{Katie's food } \frac{£48.45}{£425} \times 100\%$$

$$= 11.3529\ldots$$

$$= 11.4\% \text{ AI}$$

Katie spends a little above average on food, 11.4% compared with the average of 11% CI

(Total 3 marks)

5. Coventry Estates sells houses.

In February they sold twice as many houses as in January.

In March they sold 10 more houses than in February.

In April they sold half as many houses as in March.

Coventry Estates sold a minimum of 123 houses from 1st January to 30th April.

Find the least number of houses sold in January.

let Jan sales be x

Jan	Feb	Mar	Apr
x	$2x$	$2x+10$	$x+5$

m1
(at least 3 correct)

at least 3 terms adding
m1

$$x + 2x + 2x + 10 + x + 5 = 123$$

$$m1 \quad 6x + 15 = 123 \quad [-15]$$

$$m1 \quad 6x = 108 \quad [\div 6]$$

$$x = 18$$



should be $>$
but can accept $\geq$ or $=$

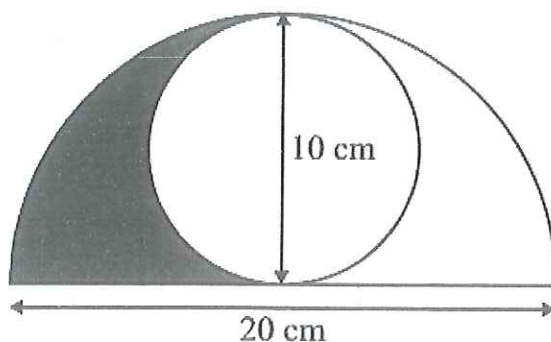
trial & imp. scores
full marks for correct
answer otherwise zero

AI

18 houses

(Total 5 marks)

6. The diagram shows a circle inside a semicircle.



The circle has a diameter of 10 cm.

The semicircle has a diameter of 20 cm.

Work out the area shaded.

Give your answer correct to 1 decimal place.

$$\text{Inner circle area} = \pi \times 5^2 \\ = 25\pi \text{ m}^2$$

$$\text{Outer semi-circle area} = \frac{\pi \times 10^2}{2} \\ = 50\pi \text{ m}^2$$

$$\text{Shaded} = \frac{1}{2}(\text{Outer semi} - \text{inner})$$

$$= \frac{50\pi - 25\pi}{2} \text{ m}^2$$

$$= \frac{25\pi}{2}$$

$$= 39.26990817$$

$$\text{AI } 39.2 - 39.3 \\ \underline{\hspace{1cm}} 39.3 \text{ cm}^2$$

(Total 5 marks)

7. Ali was asked to solve the equation $8x + 1 = 5$

Here is his working.

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

$$6x - 2 = 3x + 7$$

$$6x = 3x + 9$$

$$3x = 9$$

$$x = 3$$

should be 12
as 3×4
C1

Asif's answer is wrong.

What mistake did he make?

.....

.....

(Total 1 mark)

8. Sam invests £5000 at 2.8% per annum compound interest for 4 years.

(a) Work out the value of Sam's investment at the end of 4 years.

$$\begin{aligned} & \text{£}5000 \times (1.028)^4 \text{ M1} \\ & = \underline{\text{£}5583.96} \text{ A1} \end{aligned}$$

£.....
(3)

Andy invests £12 000 in a variable rate compound interest account.

The interest is

2% for the first year
3.5% for the second year
5% for the third year

(b) Work out the value of Andy's investment at the end of 3 years.

$$\begin{aligned} & \text{£}12000 \times 1.02 \times 1.035 \times 1.05 \text{ M1} \\ & = \underline{\text{£}13301.82} \text{ A1} \end{aligned}$$

£.....
(2)

(Total 5 marks)

9. A rectangular lawn has a length of $3x$ metres and a width of $2x$ metres. The lawn has a path of width 1 metre on three of its sides.

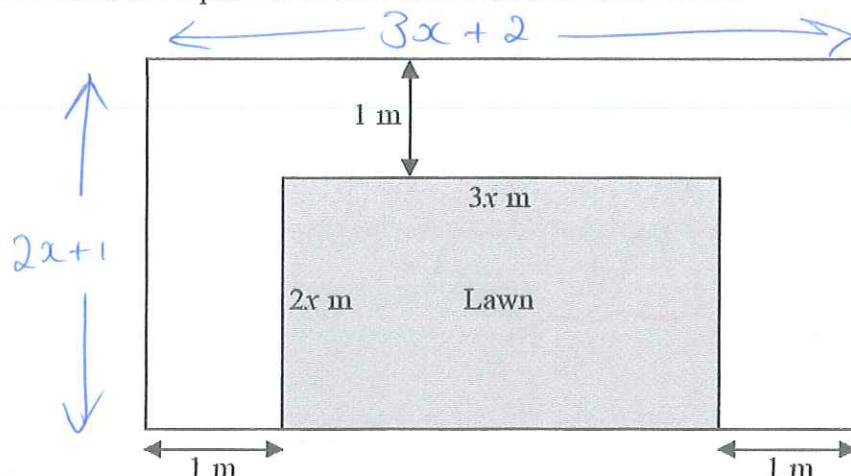


Diagram NOT accurately drawn

The total area of the lawn and the path is 100 m^2 .

- (a) Show that $6x^2 + 7x - 98 = 0$

Area lawn
 $= 2x \times 3x$
 $= 6x^2$

Area whole shape inc. path
 $100 = (3x + 2)(2x + 1) \text{ m}^2$
 $100 = 6x^2 + 7x + 2$ [100
 $0 = 6x^2 + 7x - 98$ AI
 $6x^2 + 7x - 98 = 0$

(2)

- (b) Calculate the area of the lawn.
 Show clear algebraic working.

~~$(3x + 2)(2x)$~~
 $6x^2 + 7x - 98 = 0$
 $(3x + 14)(2x - 7) = 0 \text{ m}^2$
 $3x + 14 = 0$ or $2x - 7 = 0$
 $x = -\frac{14}{3} \text{ m}^2$ or $x = \frac{7}{2} \text{ m}^2$
 x must be positive $\therefore x = \frac{7}{2}$ or 3.5

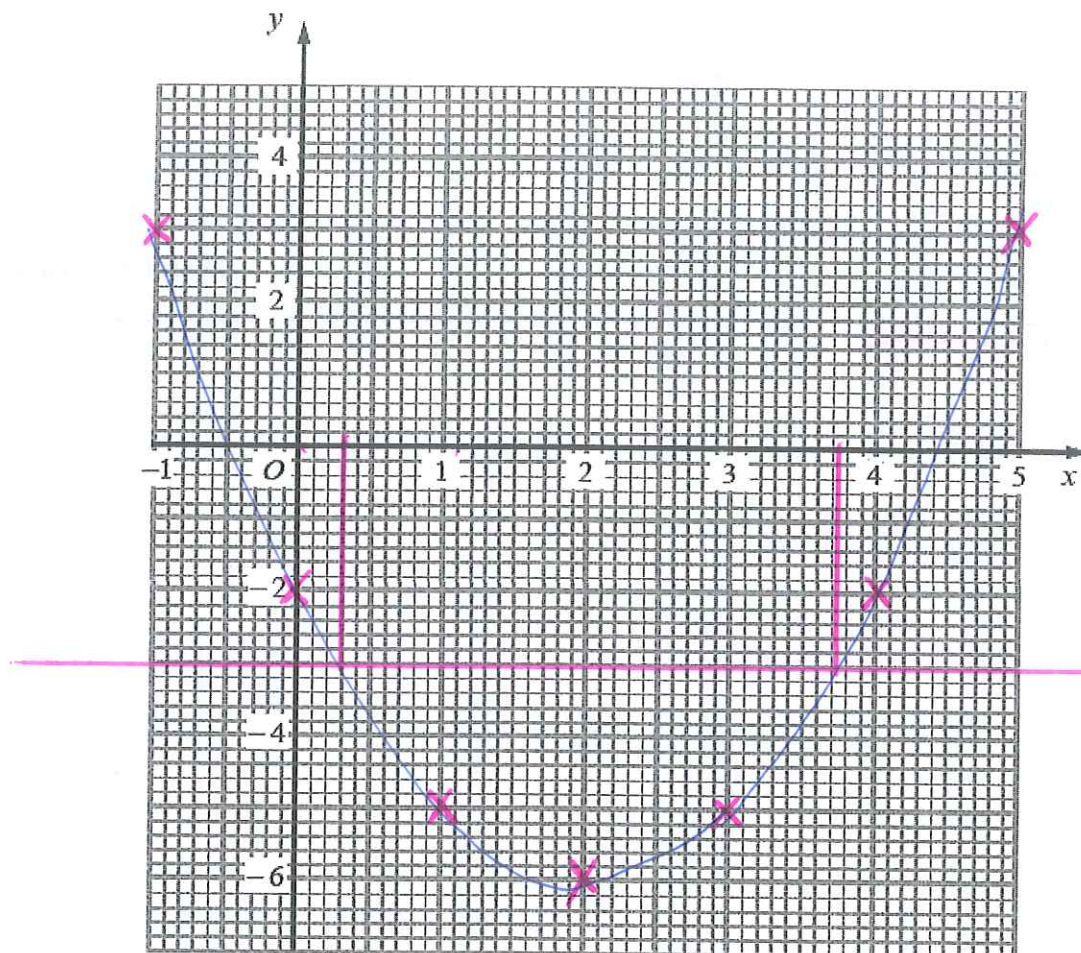
$\therefore$ Area lawn $= 2x \times 3x$
 $= 6x^2$
 $= 6(3.5)^2 \text{ m}^2$
 $= 73.5 \text{ m}^2$ AI
 m^2
 (5)
 (Total 7 marks)

10. (a) Complete the table of values for $y = x^2 - 4x - 2$

x	-1	0	1	2	3	4	5
y	3	-2	-5	-6	-5	-2	3

B2 (all 3)
(B1 any two)
(2)

- (b) On the grid, draw the graph of $y = x^2 - 4x - 2$



B1 points
B1 curve

$y = -3$

(2)

- (c) Use your graph to estimate the values of x when $y = -3$

0.2 - 0.4

$x = 0.3$ B1

$x = 3.75$ B1

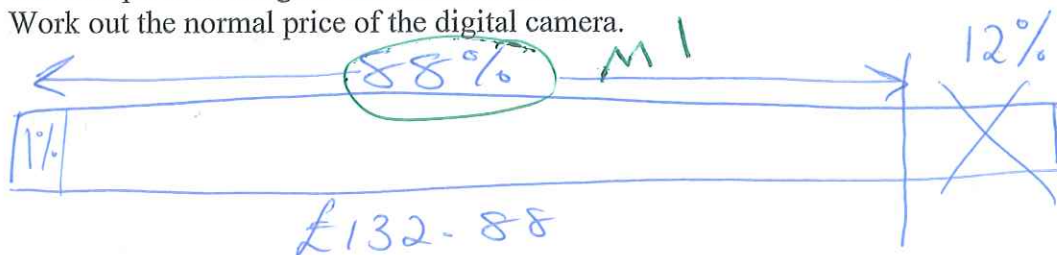
(2) 3.6 - 3.8

(Total 6 marks)

11. In a sale, normal prices are reduced by 12%.

The sale price of a digital camera is £132.88

Work out the normal price of the digital camera.



$$1\% = £132.88 \div 88$$

$$= £1.51 \quad M1$$

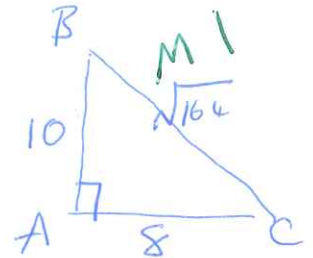
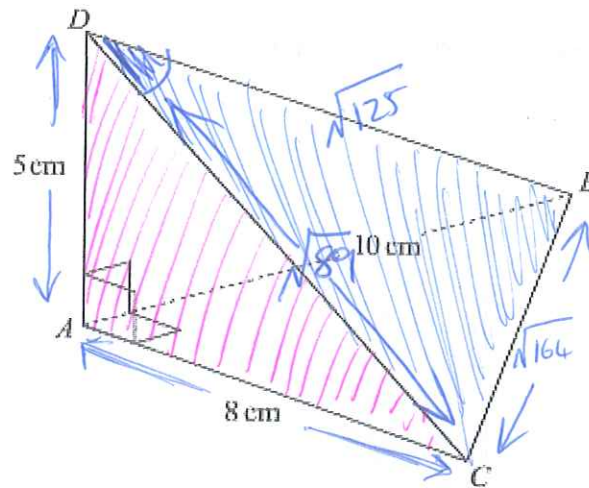
$$\therefore 100\% = £1.51 \times 100$$

$$= £151$$

£ 151

(Total 3 marks)

12.



The diagram shows a tetrahedron.

AD is perpendicular to both AB and AC .

$AB = 10$ cm.

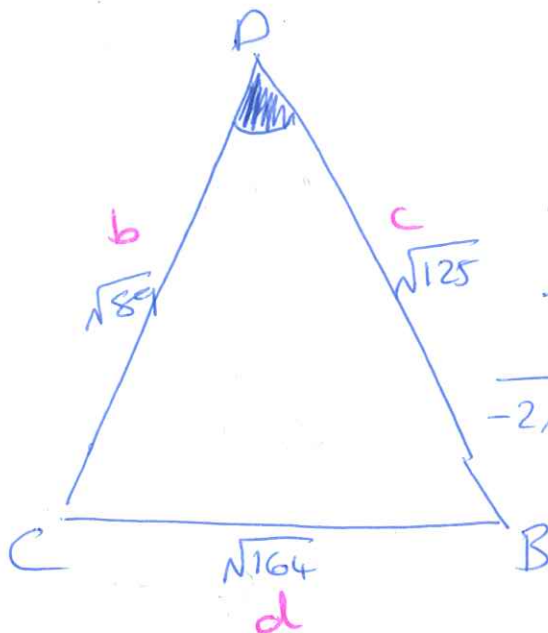
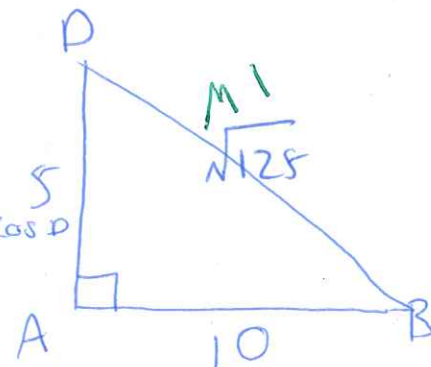
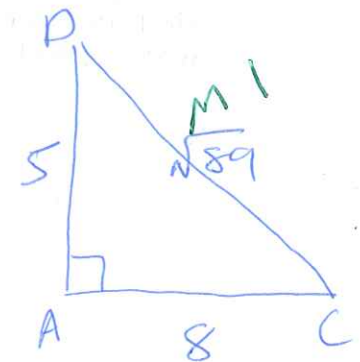
$AC = 8$ cm.

$AD = 5$ cm.

Angle $BAC = 90^\circ$.

Calculate the size of angle BDC .

Give your answer correct to 1 decimal place.



cosine rule

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

$$d^2 = b^2 + c^2 - 2bc \cos D$$

$$164 = 89 + 125 - 2(\sqrt{89})(\sqrt{125}) \cos D$$

$$-50 = -2\sqrt{89}\sqrt{125} \cos D$$

$$\frac{-50}{-2\sqrt{89}\sqrt{125}} = \cos D$$

$$D = \cos^{-1}\left(\frac{50}{2\sqrt{89}\sqrt{125}}\right)$$

$$= 76.2891$$

AI

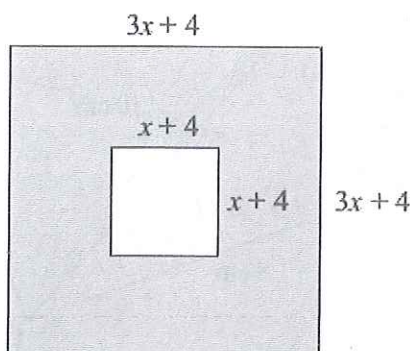
76.3°

(Total 6 marks)

76.2
76.3

13. A machine part is made by cutting a small square from the centre of a large square piece of steel.

The dimensions of the machine part are shown on the diagram.
All measurements are in cm.



The perimeter of the small square is two thirds of the perimeter of the large square.
Work out the length of a side of the small square.

$$\left. \begin{array}{l} P_{\text{small}} = 4(x+4) \\ P_{\text{large}} = 4(3x+4) \end{array} \right\} \text{m1 (either)}$$

$$P_{\text{small}} = \frac{2}{3} P_{\text{large}}$$

$$4(x+4) = \frac{2}{3} \times 4(3x+4) \quad \text{m1}$$

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

$$x+4 = 2x + \frac{8}{3} \quad [-x \quad \text{m1}]$$

$$4 = x + \frac{8}{3} \quad [-\frac{8}{3}]$$

$$\frac{4}{3} = x \quad \text{A1}$$

$$\begin{aligned} \therefore \text{side of small square} &= x+4 \\ &= \frac{4}{3} + 4 \quad \text{B1 ft} \\ &= \frac{16}{3} \quad 5\frac{1}{3} \text{ cm} \end{aligned}$$

(Total 5 marks)

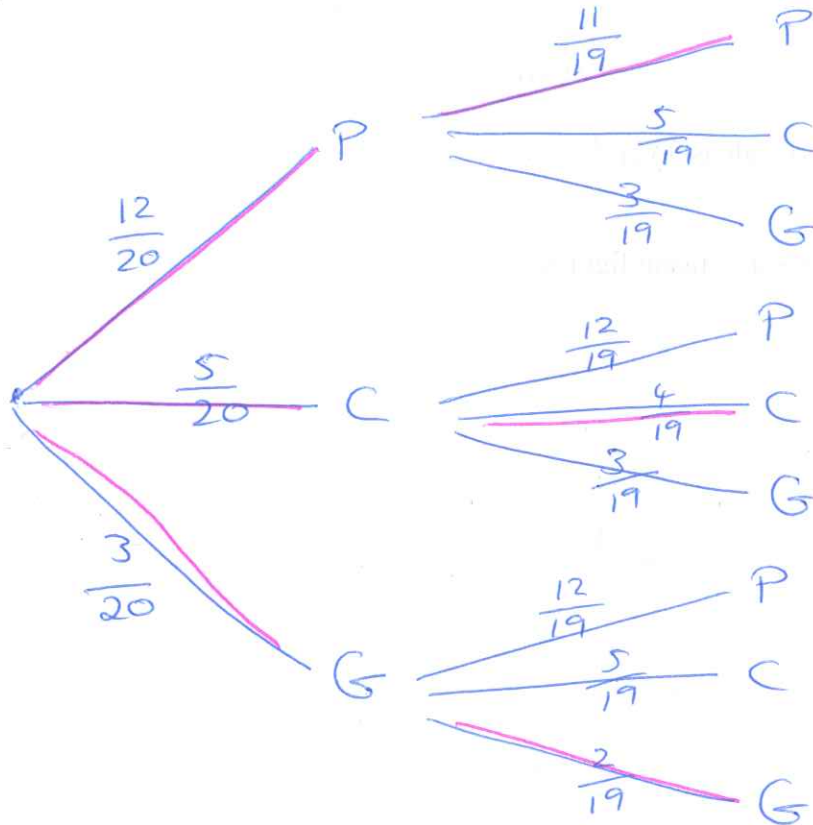
14. Carolyn has 20 biscuits in a tin.

She has

- 12 plain biscuits
- 5 chocolate biscuits
- 3 ginger biscuits

Carolyn takes at random two biscuits from the tin.

Work out the probability that the two biscuits were **not** the same type.



BI for
any set of
correct 19

eg:
 $\frac{11}{19}, \frac{4}{19}, \frac{2}{19}$

$$\begin{aligned}
 P(\text{not same type}) &= 1 - P(\text{PP or CC or GG}) \\
 &= 1 - \left[\left(\frac{12}{20} \times \frac{11}{19} \right) + \left(\frac{5}{20} \times \frac{4}{19} \right) + \left(\frac{3}{20} \times \frac{2}{19} \right) \right] \\
 &= 1 - \left[\frac{132}{380} + \frac{20}{380} + \frac{6}{380} \right] \\
 &= 1 - \frac{158}{380}
 \end{aligned}$$

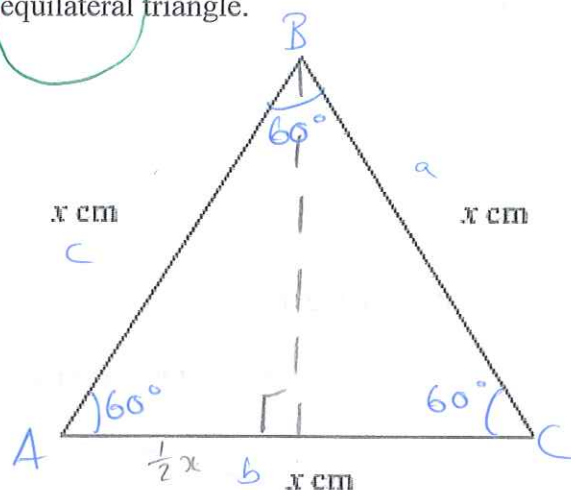
(Total 4 marks)

$$= \frac{111}{190}$$

$$\frac{222}{380}$$

A1

15. The diagram shows an equilateral triangle.



The area of the equilateral triangle is 36 cm^2 .

Find the value of x .

Give your answer correct to 3 significant figures.

$$\frac{1}{2} ab \sin C = 36$$

$$\frac{1}{2} (x)(x) \sin C = 36$$

$$\frac{x^2}{2} \sin C = 36$$

$$x^2 \sin C = 72$$

$$x^2 \sin 60 = 72 \quad \text{MI}$$

$$x^2 = \frac{72}{\sin 60}$$

$$x = \sqrt{\frac{72}{\sin 60}} \quad \text{MI}$$

$$x = 9.1180$$

$$= 9.12 \text{ (3sf)}$$

AI

$$9.11 - 9.12$$

$$\begin{aligned} 9 \times 4 \\ 6 \times 6 \\ 18 \times 2 \end{aligned}$$

$$\sqrt{x^2 - \frac{x^2}{4}}$$

$$\text{Area} = x \times \sqrt{x^2 - \frac{x^2}{4}}$$

$$36 = x \times \sqrt{\frac{4x^2 - x^2}{4}}$$

$$36 = x \times \sqrt{\frac{3x^2}{4}}$$

$$36 = x \times \frac{\sqrt{3}x}{2}$$

$$36 = \frac{\sqrt{3}x^2}{2}$$

$$\frac{72}{\sqrt{3}} = x^2$$

$$x = \sqrt{\frac{72}{\sqrt{3}}} = 6.447$$

(Total 3 marks)

16. Prove algebraically that the product of two odd numbers is **always** an odd number.

$$\begin{array}{l}
 n \text{ odd} \quad \therefore \quad n+2 \text{ odd} \\
 n(n+2) \\
 = n^2 + 2n
 \end{array}$$

Let two odd numbers be $2n+1$ and $2m+1$

$\uparrow$
 even
 odd

$\uparrow$
 even
 odd

where n and m are different.

$2n+1$ and $2m+1$ are odd since any multiple of 2 is even and adding 1 makes odd.

Product $(2n+1)(2m+1)$

$$= 4nm + 2n + 2m + 1$$

$\uparrow$ $\nwarrow$ $\nearrow$
 Even Even
 since since
 mult mult
 of 4 of 2

$$\begin{array}{l}
 \text{Even} + \text{Even} + \text{Even} + 1 \\
 \underbrace{\hspace{10em}}_{\text{Even}} + 1 = \text{Odd}
 \end{array}$$

(Total 3 marks)

17. A car is approaching a set of traffic lights.
The traffic lights turn red.

It takes the car 4 seconds to slow down to a stop.

Here is the speed-time graph for the 5 seconds until the car stops.



- (a) Work out an estimate for the distance the car travels in these 5 seconds.

Distance travelled is Area under curve
 $= 20 + 15 + 7.5 + 2.5 + 0 = 45$
 $= 45 \text{ m}$

..... m
(3)

- (b) Is your answer to (a) an underestimate or an overestimate of the actual distance the car travels in these 5 seconds?

Give a reason for your answer.

Underestimate Over-estimate since
 trapeziums include extra area above curve

(1)

(Total 4 marks)

18. A farmer wants to estimate the number of rabbits on his farm.

On Monday he catches 120 rabbits.
He puts a tag on each rabbit.
He then lets the rabbits run away.

$$\text{Population} = n$$
$$\therefore \frac{120}{n} \text{ are tagged}$$

On Tuesday the farmer catches 70 rabbits.
15 of these rabbits have a tag on them.

$$\frac{15}{70} \text{ of } \text{population tagged}$$

Work out an estimate for the total number of rabbits on the farm.
You must write down any assumptions you have made.

$$\cancel{\frac{120}{n}} \quad \left(\frac{15}{70} \right) \text{ of } \left(\frac{120}{n} \right) ml$$

$$\frac{15}{70} \text{ of Whole Pop} = \frac{120}{n} ml$$

$$\frac{15}{70} \times 1 = \frac{120}{n}$$

$$15n = 8400$$

$$n = 560$$

Al

(Total 4 marks)

TOTAL FOR PAPER IS 80 MARKS

