

Write your name here					
Surname			Other names		
Centre Number		Candidate Number			
Pearson Edexcel Level 1/Level 2 GCSE (9 - 1)					
<h1 style="margin: 0;">Mathematics</h1> <h2 style="margin: 0;">Paper 2 (Calculator)</h2> <div style="text-align: right; margin-top: 20px;"> <h3 style="margin: 0;">Higher Tier</h3> </div>					
Mock Set 2 – Spring 2017 Time: 1 hour 30 minutes				Paper Reference <h2 style="margin: 0;">1MA1/2H</h2>	
You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.					Total Marks <div style="border: 1px solid black; width: 40px; height: 40px; margin: 0 auto;"></div>

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.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- 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. 100 adults were asked how they keep fit.

Each adult goes to the gym or runs or cycles.

45 of these adults are female.

30 of the 52 adults who go to the gym are female.

35 adults run.

9 men cycle.

How many females run?

	Gym	Run	CYCLE	
M	22	24	9	55
F	30	11	4	45
	52	35	13	100

..... 11

(Total for Question 1 is 3 marks)

2. On a school trip the ratio of the number of teachers to the number of students is 1 : 15

The ratio of the number of male students to the number of female students is 7 : 5

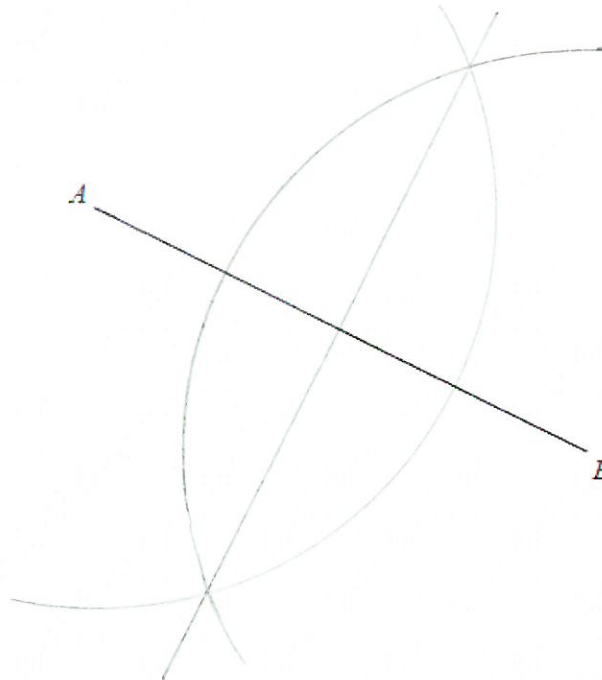
Work out what percentage of all the people on the trip are female students.
Give your answer correct to the nearest whole number.

$$\frac{15}{16} \times \frac{5}{12} \times 100 = 39.0625$$

.....³⁹.....%

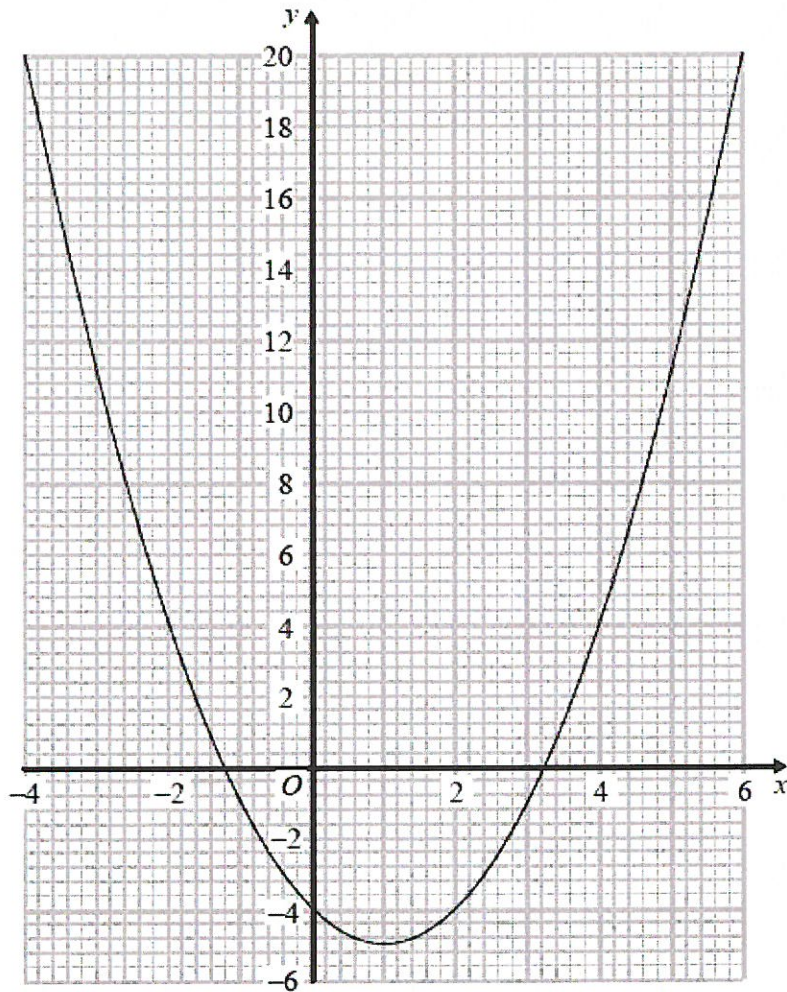
(Total for Question 2 is 3 marks)

3. In the space below, use ruler and compasses to construct the perpendicular bisector of line *AB*.



(Total for Question 3 is 2 marks)

4. Here is the graph of $y = x^2 - 2x - 4$



(a) Write down estimates for the roots of $x^2 - 2x - 4 = 0$

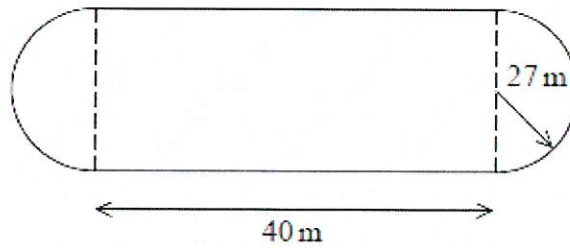
..... -1.2 , 3.2
(2)

(b) Write down the coordinates of the turning point of $y = x^2 - 2x - 4$

(..... 1 , -5)
(1)

(Total for Question 4 is 3 marks)

5. The diagram shows a cycle track.



The track has two straight sides each of length 40 m.
Each end of the track is a semicircle of radius 27 m.

The diameter of each wheel of Ian's bike is 590 mm. = 0.59 m
Ian is going to ride his bike around the track once.

Calculate how many complete revolutions each wheel of his bike will make.

PERIMETER OF TRACK =

$$2 \times \frac{1}{2} \times 2\pi \times 27 + 2 \times 40 = 249.646 \text{ m}$$

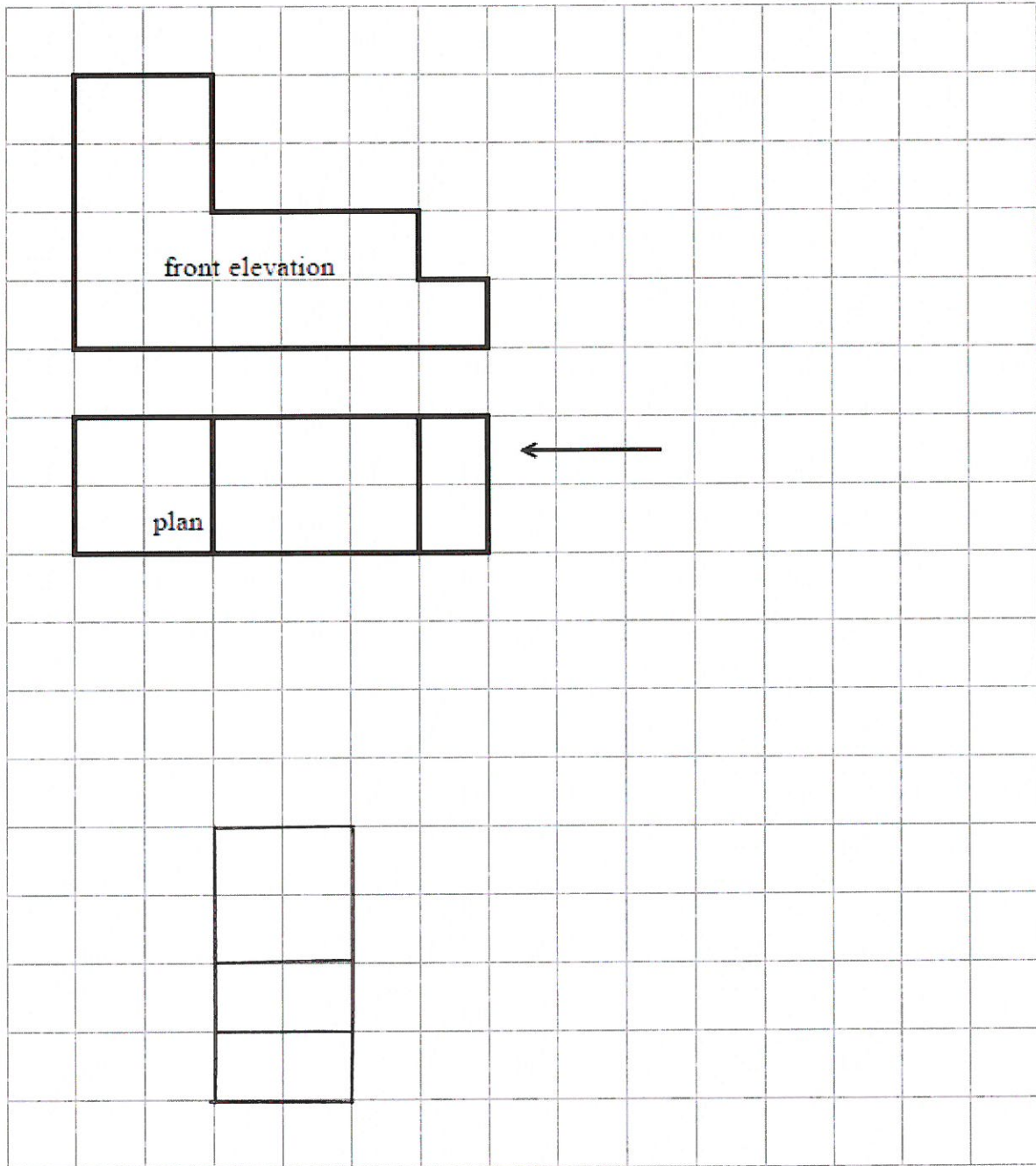
$$\text{CIRCUMFERENCE OF WHEEL} = 0.59\pi = 1.8535 \text{ m}$$

$$\text{NUMBER OF REVOLUTIONS} = \frac{249.646}{1.8535} = 134.69$$

..... 134

(Total for Question 5 is 5 marks)

6. The front elevation and plan of a solid are shown on the grid.
On the grid, draw the side elevation from the direction of the arrow.



(Total for Question 6 is 2 marks)

7. The distance from the Earth to the Sun is 1.496×10^{11} metres.
The speed of light is 3×10^8 metres per second.

(a) Show that, correct to 3 significant figures, light will take 0.139 hours to travel from the Sun to the Earth.

$$\begin{aligned} \text{TIME} &= \frac{1.496 \times 10^{11}}{3 \times 10^8} \text{ SECONDS} \\ &= \frac{1.496 \times 10^{11}}{3 \times 10^8 \times 3600} \text{ HOURS} \\ &= 0.139 \text{ HOURS} \end{aligned}$$

(3)

1 googol is 1×10^{100}

Danesh says,

When I multiply 1.496×10^{11} by 6.68×10^9
I get nearly 1 googol because $1.496 \times 10^{11} \times 6.68 \times 10^9 = 9.99 \times 10^{99}$

Is Danesh correct?

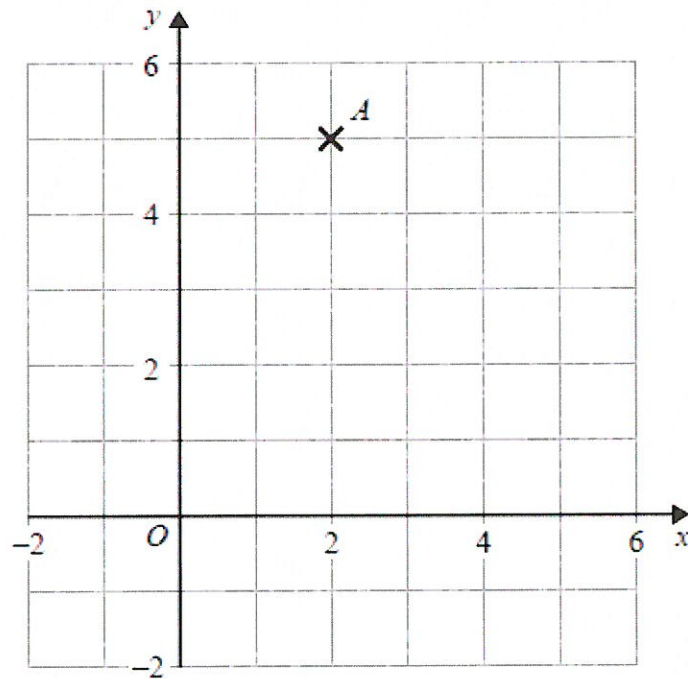
(b) Give a reason for your answer.

DANESH IS NOT CORRECT. HE HAS MULTIPLIED THE INDICES AND HE SHOULD HAVE ADDED THEM. THE ANSWER IS 9.99×10^{20}

(1)

(Total for Question 7 is 4 marks)

8. Find an equation of the straight line with gradient 3 that passes through point A.



$$A \text{ is } (2, 5)$$

$$y = 3x + c$$

$$\text{At } A \quad 5 = 3 \times 2 + c = 6 + c$$

$$\therefore c = -1$$

$$\dots\dots\dots y = 3x - 1 \dots\dots\dots$$

(Total for Question 8 is 2 marks)

9. Natasha pays £13 995 for a car.
Lauren pays £14 495 for a car.

Assume that

the rate of depreciation for Natasha's car is 12% per annum
and the rate of depreciation for Lauren's car is 13% per annum.

- (a) Work out whose car will have the greater value at the end of 3 years?
You must show all your working.

$$\text{NATASHA : } 13995 \times 0.88^3 = \text{£}9537.20$$

$$\text{LAUREN : } 14495 \times 0.87^3 = \text{£}9545.00$$

LAUREN'S CAR WILL HAVE THE GREATER VALUE.

(4)

The rate of depreciation assumed for Natasha's car was too low.

- (b) How does this affect the value of her car at the end of 3 years?

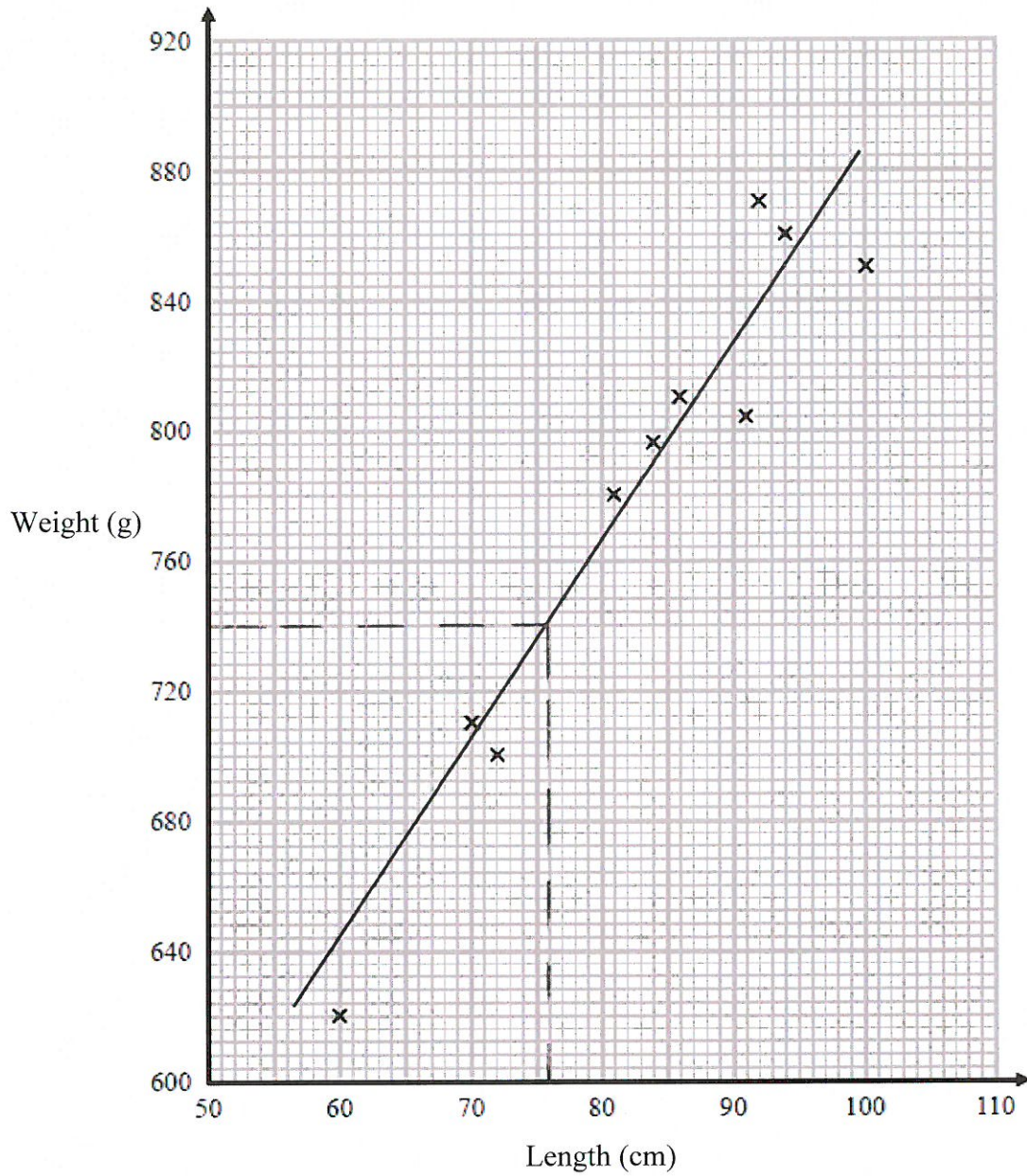
.....IT WILL BE WORTH LESS.....

.....

(1)

(Total for Question 9 is 5 marks)

10. The scatter graph shows information about 10 adult snakes of the same type. It shows the length and weight of each snake.



An adult snake of this type has a weight of 740 g.

- (a) Use the scatter graph to estimate the length of this snake.

$$\dots\dots\dots 76 \dots\dots\dots \text{cm}$$

$$(72 - 80) \quad (2)$$

Steven wants to estimate the weight of an adult snake of length 110 cm.

He says he will draw a line of best fit and read off the weight at 110 cm.

(b) Explain what is wrong with his method.

..... 110cm IS BEYOND THE RANGE OF THE DATA

(1)

(Total for Question 10 is 3 marks)

11. Write the number 47 805 000 in standard form.

..... 4.7805×10^7

(Total for Question 11 is 1 mark)

12. Factorise $x^2 - 121$

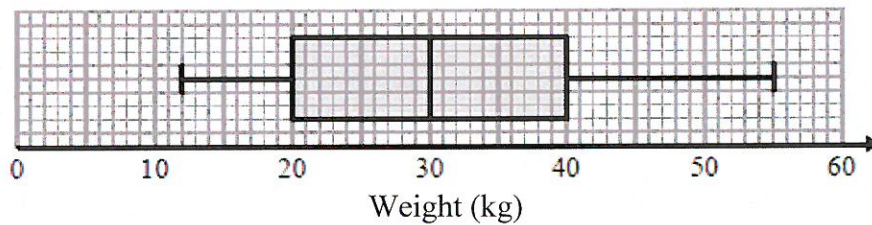
..... $(x+11)(x-11)$

(Total for Question 12 is 1 mark)

13. The table shows some information about the weights, in kg, of some boxes.

Minimum	Lower Quartile	Median	Upper Quartile	Range
12	20	32	40	55

Ben uses this information to draw the box plot below.



Write down two things wrong with this box plot.

1. UPPER LIMIT = 55, NOT THE RANGE (RANGE = $55 - 12 = 43$)
2. MEDIAN = $30\frac{2}{10}$, NOT 30.

(Total for Question 13 is 2 marks)

14. Solve the simultaneous equations

$$4x + 6y = 5 \quad \times 5$$

$$7x + 5y = -10.5 \quad \times 6$$

$$20x + 30y = 25$$

$$42x + 30y = -63$$

$$\therefore 22x = -88$$

$$\therefore x = -4$$

$$4x - 4 + 6y = 5$$

$$-16 + 6y = 5$$

$$6y = 5 + 16 = 21$$

$$y = \frac{21}{6} = \frac{7}{2}$$

$$x = \dots -4 \dots$$

$$y = \dots \frac{7}{2} \text{ or } 3.5 \dots$$

(Total for Question 14 is 4 marks)

15. Prove algebraically that the difference between the squares of any two consecutive integers is always an odd number.

LET THE 2 INTEGERS BE $n, n+1$

$$(n+1)^2 = n^2 + 2n + 1$$

$$\begin{aligned} \text{DIFFERENCE BETWEEN SQUARES} &= n^2 + 2n + 1 - n^2 \\ &= 2n + 1 \end{aligned}$$

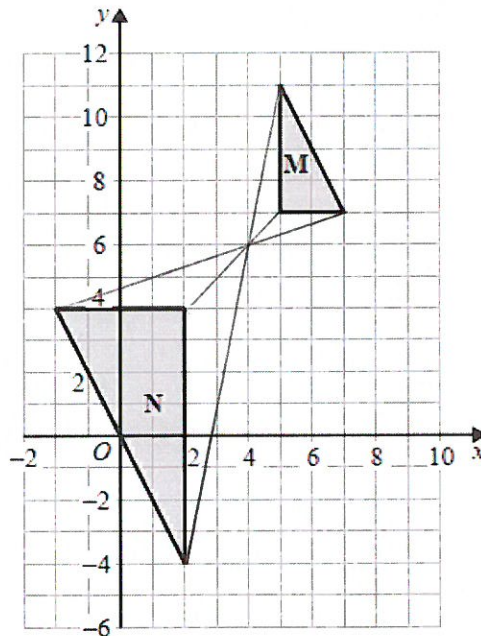
is MULTIPLE OF 2 PLUS 1

∴ ODD

QED

(Total for Question 15 is 3 marks)

- 16.



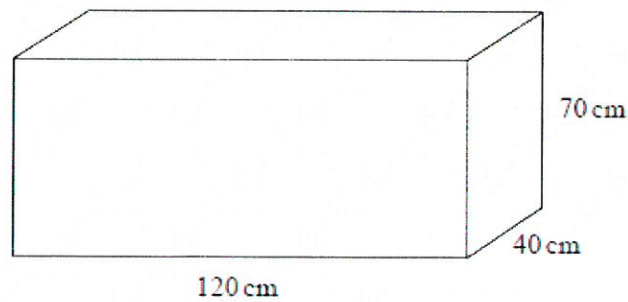
Describe fully the single transformation that maps triangle M onto triangle N.

ENLARGEMENT SCALE FACTOR -2

CENTRE OF ENLARGEMENT $(4, 6)$

(Total for Question 16 is 2 marks)

17. The diagram shows Helen's fish tank.
All the dimensions are correct to the nearest centimetre.



Helen is going to use a bucket to fill the fish tank completely with water.
There are 14 litres, correct to the nearest litre, of water in a full bucket.

Will 25 full buckets of water definitely fill the fish tank?
Justify your answer.

UPPER LIMITS OF DIMENSIONS OF TANK ARE 70.5, 40.5, 120.5

$$\therefore \text{UPPER LIMIT OF VOLUME} = 70.5 \times 40.5 \times 120.5 \text{ cm}^3$$

$$\begin{aligned} \text{LOWER LIMIT OF VOLUME OF WATER} &= 13.5 \text{ LITRES} \\ &= 13500 \text{ cm}^3 \end{aligned}$$

NUMBER OF BUCKETS REQUIRED TO DEFINITELY FILL THE TANK

$$= \frac{70.5 \times 40.5 \times 120.5}{13500}$$

$$= 25.49$$

SO 25 FULL BUCKETS WILL NOT DEFINITELY BE ENOUGH.

(Total for Question 17 is 4 marks)

18. T is inversely proportional to the cube of u .

When $u = 5$, $T = 0.0096$

Find the value of u when $T = 0.15$

$$T \propto \frac{1}{u^3}$$

$$\therefore T = \frac{k}{u^3}$$

$$0.0096 = \frac{k}{5^3} = \frac{k}{125}$$

$$\therefore k = 125 \times 0.0096$$

$$\therefore k = 1.2$$

$$\therefore T = \frac{1.2}{u^3}$$

$$\text{WHEN } T = 0.15$$

$$0.15 = \frac{1.2}{u^3}$$

$$\therefore u^3 = \frac{1.2}{0.15}$$

$$\therefore u = \sqrt[3]{\frac{1.2}{0.15}} = 2$$

..... 2

(Total for Question 18 is 3 marks)

19. By completing the square, find the coordinates of the turning point of the curve with equation $y = x^2 + 10x + 18$

You must show all your working.

$$(x+5)^2 = x^2 + 10x + 25$$

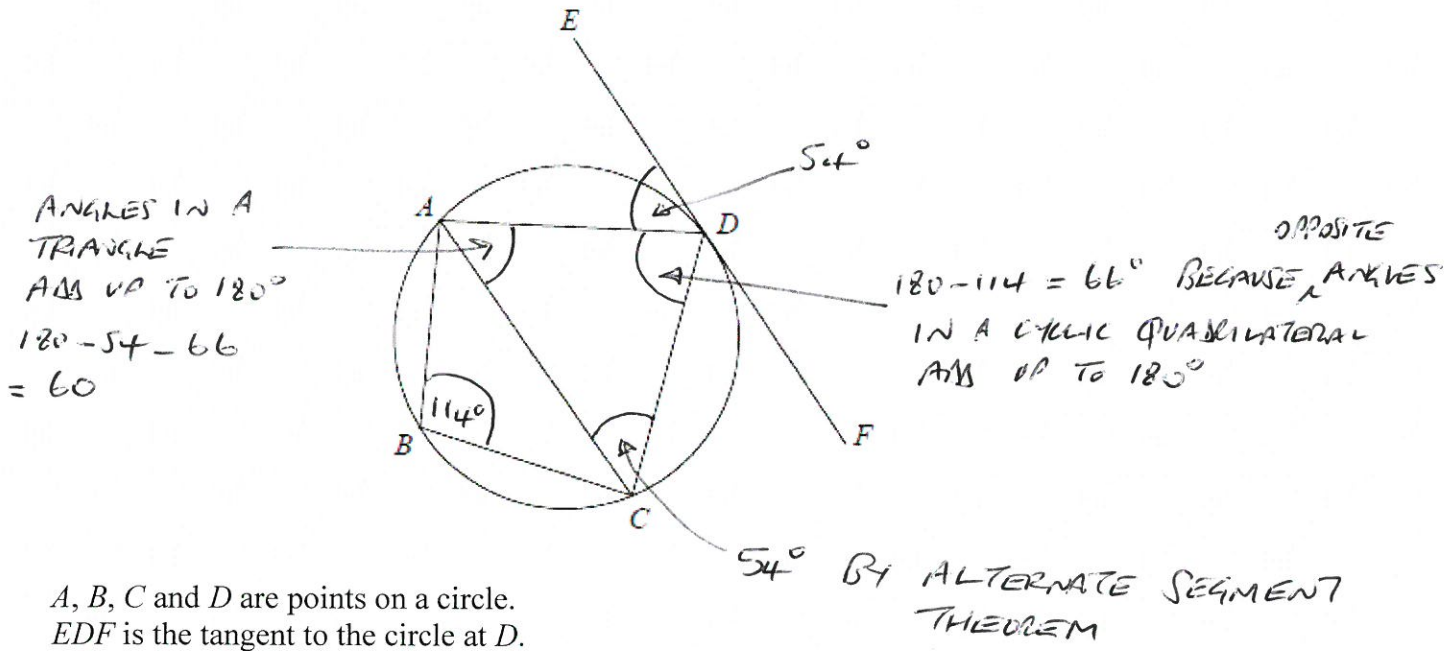
$$\therefore (x+5)^2 - 25 + 18 = x^2 + 10x + 18$$

$$\therefore y = (x+5)^2 - 7$$

(..... -5 , -7)

(Total for Question 19 is 3 marks)

20.



A, B, C and D are points on a circle.
 EDF is the tangent to the circle at D .

Angle $ADE = 54^\circ$
 Angle $ABC = 114^\circ$

Work out the size of angle CAD .
 You must give a reason for each stage of your working.

..... 60°

(Total for Question 20 is 4 marks)

21. f and g are functions such that

$$f(x) = 3x^2 \text{ and } g(x) = \frac{1}{x-2}$$

Find $gf(4)$.

Give your answer as a fraction.

$$f(4) = 3 \times 4^2 = 48$$

$$g(48) = \frac{1}{48-2} = \frac{1}{46}$$

$$\frac{1}{46}$$

(Total for Question 21 is 2 marks)

22. $(a + \sqrt{8})^2$ can be written in the form $c + d\sqrt{2}$, where a , c and d are integers.

Find, in terms of a , an expression for c and an expression for d .

$$(a + \sqrt{8})^2 = (a + \sqrt{8})(a + \sqrt{8}) = a^2 + 8 + 2a\sqrt{8}$$

$$\sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}$$

$$\therefore 2a\sqrt{8} = 2a \times 2\sqrt{2} = 4a\sqrt{2}$$

$$c = a^2 + 8$$

$$d = 4a$$

(Total for Question 22 is 3 marks)

23. (a) Show that the equation $2x^3 + 4x = 3$ has a solution between 0 and 1.

$$2x^3 + 4x - 3 = 0 \quad \text{LET } y = 2x^3 + 4x - 3$$

$$x = 0 \quad y = -3$$

$$x = 1 \quad y = 2 + 4 - 3 = 3$$

SOLUTION CHANGES FROM NEGATIVE TO POSITIVE
THEREFORE MUST BE ZERO BETWEEN $x = 0$ AND $x = 1$
THEREFORE HAS A SOLUTION BETWEEN $x = 0$ AND $x = 1$ (2)

(b) Show that $2x^3 + 4x = 3$ can be arranged to give $x = \frac{3}{4} - \frac{x^3}{2}$

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

$$x = \frac{3}{4} - \frac{2x^3}{4}$$

$$x = \frac{3}{4} - \frac{x^3}{2}$$

(1)

(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \frac{3}{4} - \frac{x_n^3}{2}$ three times to find an estimate for the solution to $2x^3 + 4x = 3$

$$x_1 = \frac{3}{4} - \frac{x_0^3}{2} = \frac{3}{4} = 0.75$$

$$x_2 = \frac{3}{4} - \frac{x_1^3}{2} = \frac{3}{4} - \frac{0.75^3}{2} = 0.5390625$$

$$x_3 = \frac{3}{4} - \frac{x_2^3}{2} = \frac{3}{4} - \frac{0.5390625^3}{2}$$

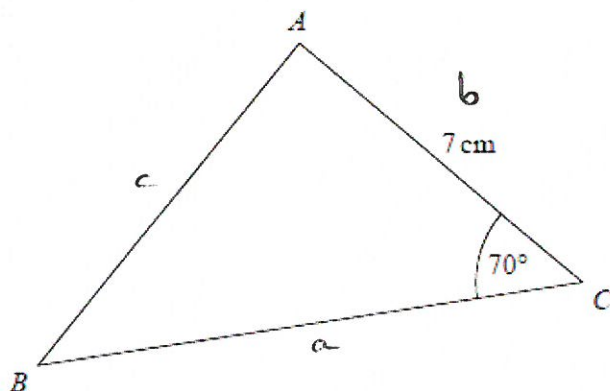
$$= 0.671677351$$

$$\dots\dots\dots 0.672 \dots\dots\dots$$

(3)

(Total for Question 23 is 6 marks)

24.



The area of triangle ABC is 42 cm^2

Find the length of AB .

Give your answer correct to 3 significant figures.

$$\text{AREA} = \frac{1}{2} ab \sin C$$

$$\therefore 42 = \frac{1}{2} \times 7a \times \sin 70$$

$$\therefore a = \frac{2 \times 42}{7 \sin 70} = 12.7701$$

$$\begin{aligned} c^2 &= 7^2 + 12.7701^2 - 2 \times 7 \times 12.7701 \cos 70 \\ &= 212.0763 - 178.7214 \cos 70 \\ &= 150.9295 \end{aligned}$$

$$\begin{aligned} \therefore c &= \sqrt{150.9295} \\ &= 12.285 \end{aligned}$$

..... 12.3 cm

(Total for Question 24 is 5 marks)

25. There are some red counters and some white counters in a bag.
At the start, 7 of the counters are red, the rest of the counters are white.

↳ LET THIS BE n .

Alfie takes at random a counter from the bag.

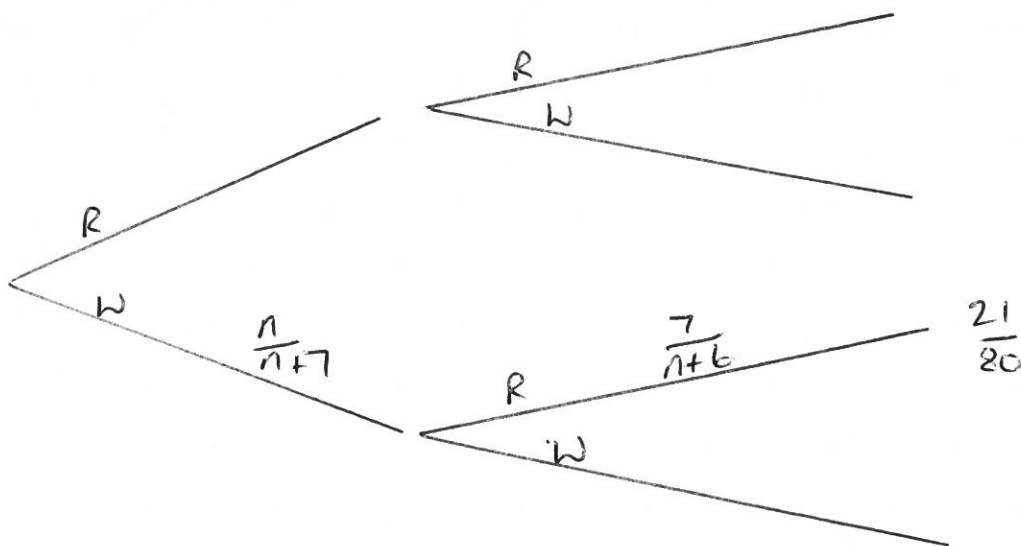
- * He does not put the counter back in the bag.

Alfie then takes at random another counter from the bag.

∴ TOTAL COUNTERS = $n + 7$

The probability that the first counter Alfie takes is white **and** the second counter Alfie takes is red is $\frac{21}{80}$.

Work out the number of white counters in the bag at the start.



$$\frac{n}{n+7} \times \frac{7}{n+6} = \frac{21}{80}$$

$$\therefore 7n \times 80 = 21(n+7)(n+6)$$

$$\therefore 560n = 21(n^2 + 13n + 42)$$

$$\therefore 21n^2 + 273n + 882 - 560n = 0$$

$$\therefore 21n^2 - 287n + 882 = 0$$

$$\therefore 3n^2 - 41n + 126 = 0$$

$$n = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \begin{array}{l} a = 3 \\ b = -41 \\ c = 126 \end{array}$$

$$n = \frac{41 \pm \sqrt{41^2 - 4 \times 3 \times 126}}{6}$$

$$= \frac{41 \pm 13}{6} = 9, \frac{28}{6}$$

n IS AN INTEGER ∴ $n = 9$

9

(Total for Question 25 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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