

Name: _____

Maths Genie Stage 13

Test A

Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**
- **Calculators may be used.**

Information

- 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

- 1 (a) Write $x^2 - 8x + 3$ in the form $(x + a)^2 + b$ where a and b are integers.

$$(x - 4)^2 - 16 + 3$$

$$(x - 4)^2 - 13$$

$$\dots \frac{(x - 4)^2 - 13}{(2)}$$

- (b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = x^2 - 8x + 3$

$$\dots \frac{(4, -13)}{(1)}$$

(Total for Question 1 is 3 marks)

- 2 n is an integer.

Prove algebraically that the sum of $(n + 3)(n + 2)$ and $n + 3$ is always a square number.

$$(n + 3)(n + 2) + n + 3$$

$$n^2 + 2n + 3n + 6 + n + 3$$

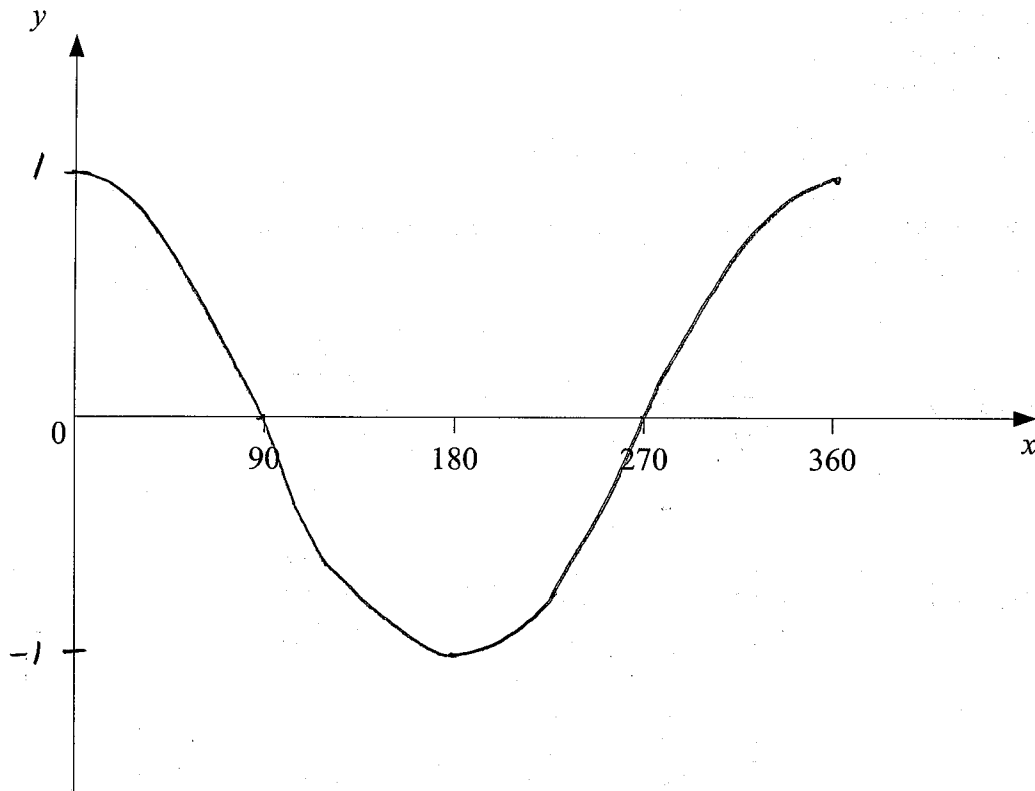
$$n^2 + 6n + 9$$

$$(n + 3)(n + 3)$$

$$\underline{\underline{(n + 3)^2}}$$

(Total for Question 2 is 3 marks)

3 Sketch the graph of $y = \cos x^\circ$ for $0 \leq x \leq 360$



(Total for Question 3 is 3 marks)

4 Write $\frac{x^2 - x - 30}{3x^2 + 13x - 10}$ in the form $\frac{x + a}{bx + c}$ where a , b , and c are integers.

$$\frac{(x - 6)(x + 5)}{(3x - 2)(x + 5)}$$

$$\frac{x - 6}{3x - 2}$$

(Total for Question 4 is 3 marks)

5 There are 14 counters in a bag.

6 of the counters are red.

5 of the counters are blue.

3 of the counters are green.

Billie takes two counters are taken at random from the bag.

Work out the probability that the counters Billie takes are different colours.

You must show your working.

$$P(R, R) = \frac{6}{14} \times \frac{5}{13} = \frac{30}{182}$$

$$P(B, B) = \frac{5}{14} \times \frac{4}{13} = \frac{20}{182}$$

$$P(G, G) = \frac{3}{14} \times \frac{2}{13} = \frac{6}{182}$$

$$P(\text{Same Colour}) = \frac{30}{182} + \frac{20}{182} + \frac{6}{182} = \frac{56}{182}$$

$$P(\text{Different Colours}) = 1 - \frac{56}{182} = \frac{126}{182}$$

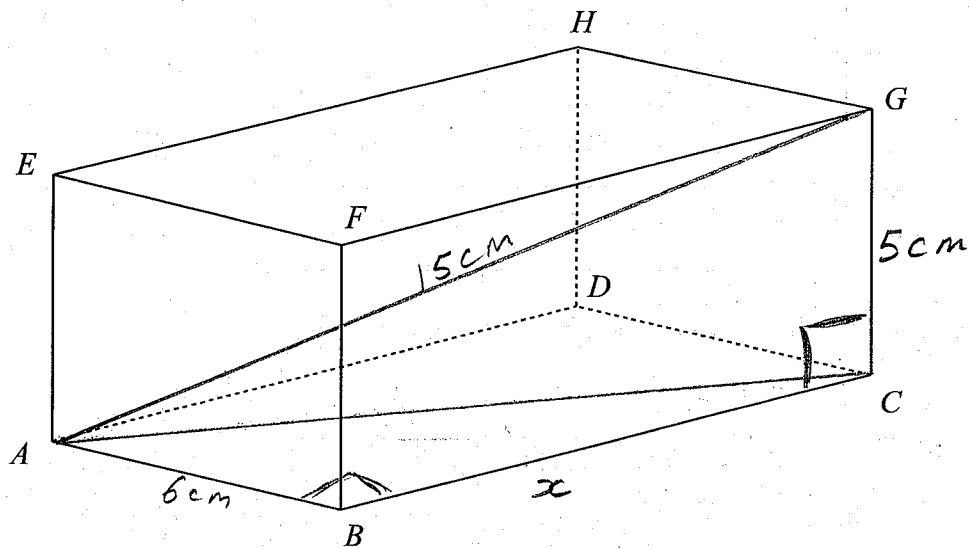
$$\frac{126}{182}$$

(Total for Question 5 is 4 marks)

OR $\frac{9}{13}$

6 The diagram shows a cuboid $ABCDEFGH$.

$AB = 6 \text{ cm}$
 $AE = 5 \text{ cm}$
 $AG = 15 \text{ cm}$



Calculate the length of AD .
Give your answer correct to 3 significant figures.

$$AC^2 + CG^2 = AG^2$$

$$AC^2 + 5^2 = 15^2$$

$$AC^2 = 15^2 - 5^2$$

$$AC^2 = 200$$

$$AC = 10\sqrt{2}$$

$$x^2 + 6^2 = (10\sqrt{2})^2$$

$$x^2 = 200 - 6^2$$

$$x = \sqrt{164}$$

$$= 12.8 \text{ cm}$$

12.8

cm

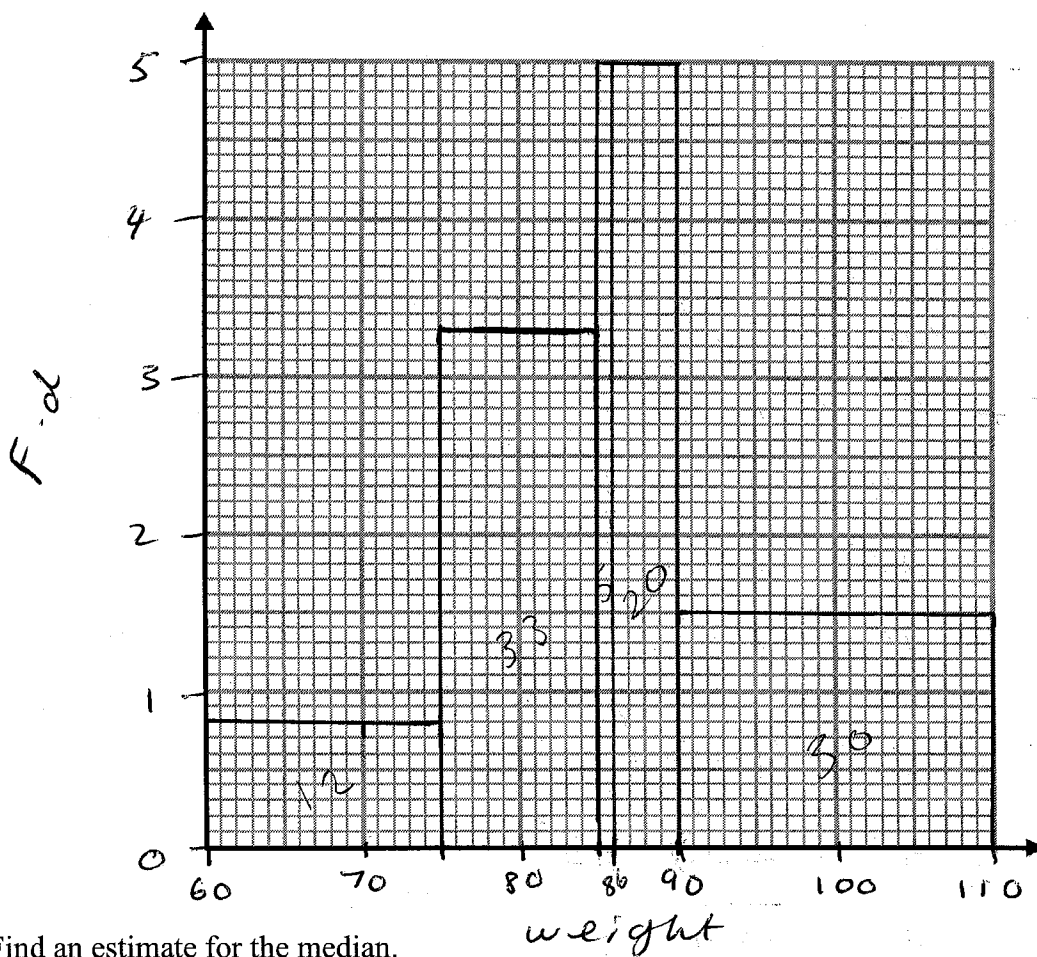
(Total for Question 6 is 4 marks)

7 The table shows information about the weight of 100 pigs.

Weight (kg)	Frequency
$60 < w \leq 75$	12
$75 < w \leq 85$	33
$85 < w \leq 90$	25
$90 < w \leq 110$	30

F.d
 0.8
 3.3
 5
 1.5

(a) On the grid, draw a histogram for the information in the table.

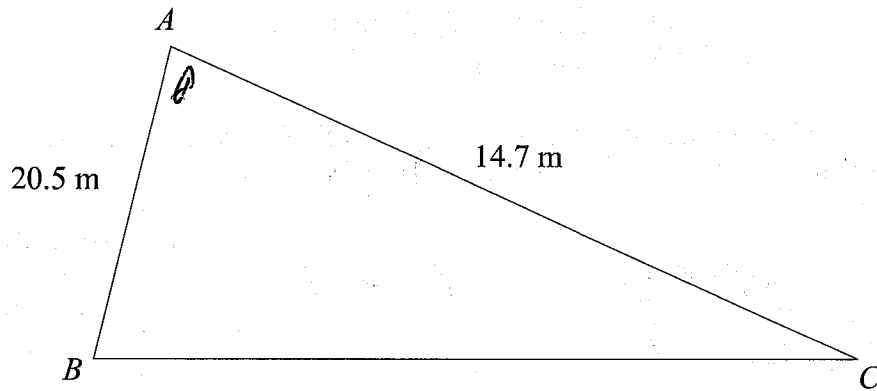


(b) Find an estimate for the median.

.....86.....kg
 (2)

(Total for Question 7 is 5 marks)

8



The area of the triangle is 100m^2
 Calculate the perimeter of triangle ABC .
 Give your answer to 3 significant figures.

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

$$\frac{1}{2} (20.5)(14.7) \sin \theta = 100$$

$$\sin \theta = \frac{100}{\frac{1}{2}(20.5)(14.7)}$$

$$\theta = \sin^{-1}\left(\frac{4000}{6027}\right)$$

$$= 41.58114^\circ$$

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

$$= (20.5)^2 + (14.7)^2 - 2(20.5)(14.7) \cos(41.58)$$

$$= 185.5$$

$$a = \sqrt{185.5}$$

$$= \underline{\underline{13.6 \text{ m}}}$$

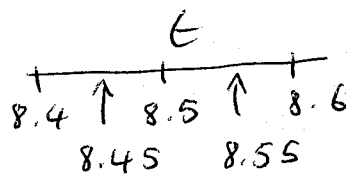
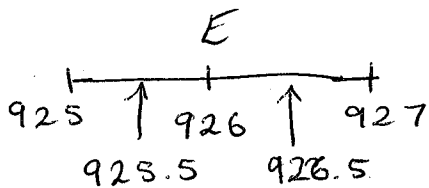
.....13.6.....m

(Total for Question 8 is 5 marks)

9 $P = \frac{E}{t}$ $E = 926$ correct to 3 significant figures
 $t = 8.5$ correct to 1 decimal place

By considering bounds, work out the value of P to a suitable degree of accuracy.
 Give a reason for your answer.

$$\text{upper } P = \frac{\text{upper } E}{\text{lower } t} \qquad \text{Lower } P = \frac{\text{Lower } E}{\text{upper } t}$$



$$\text{upper } P = \frac{926.5}{8.45}$$

$$= \underline{\underline{109.6449\dots}}$$

$$\text{Lower } P = \frac{925.5}{8.55}$$

$$= \underline{\underline{108.2456\dots}}$$

$$P = \underline{\underline{110}} \text{ (2sf)}$$

Both the upper bound and lower bound round to 110 to 2sf (Total for Question 9 is 5 marks)