

Name: _____

Maths Genie Stage 13

Test C

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 The table shows information about the age of 80 teachers.

Age (years)	Frequency
$20 < a \leq 30$	23
$30 < a \leq 35$	21
$35 < a \leq 40$	14
$40 < a \leq 50$	16
$50 < a \leq 65$	6

F. d

2.3

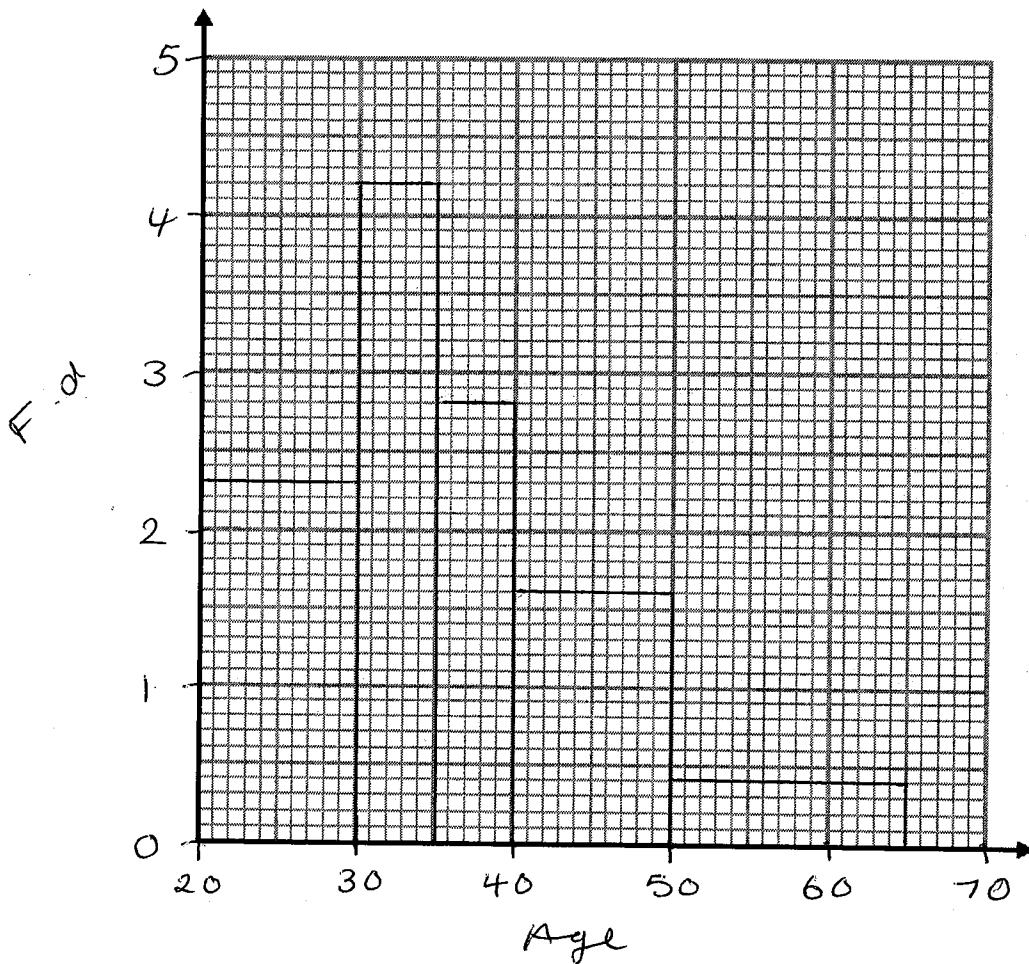
4.2

2.8

1.6

0.4

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



(Total for question 1 is 3 marks)

2 Simplify fully $\frac{2x+4}{5x-15} \div \frac{x^2-8x-20}{2x^2-x-15}$

$$\frac{2x+4}{5x-15} \times \frac{2x^2-x-15}{x^2-8x-20}$$

$$\frac{2(\cancel{x+2})(2x+5)(\cancel{x-3})}{5(\cancel{x-3})(x-10)(\cancel{x+2})}$$

$$\frac{2(2x+5)}{5(x-10)}$$

$$\frac{2(2x+5)}{5(x-10)}$$

(Total for Question 2 is 3 marks)

3 Prove that the sum of 3 consecutive even numbers is always a multiple of 6.

$$2n + 2n + 2 + 2n + 4$$

$$6n + 6$$

$$\underline{\underline{6(n+1)}}$$

(Total for Question 3 is 2 marks)

4

$$V = IR$$

$I = 4.29$ correct to 2 decimal places

$R = 16.173$ correct to 3 decimal places

Work out the upper bound for V .

Give your answer to 2 decimal places.

$$\begin{aligned} \text{upper } V &= \text{upper } I \times \text{upper } R \\ &= 4.295 \times 16.1735 \\ &= 69.47 \end{aligned}$$

69.47

(Total for Question 4 is 3 marks)

5 (a) Write $3x^2 - 12x + 19$ in the form $a(x + b)^2 + c$ where a , b , and c are integers.

$$3(x^2 - 4x) + 19$$

$$3((x - 2)^2 - 4) + 19$$

$$3(x - 2)^2 - 12 + 19$$

$$3(x - 2)^2 + 7$$

$$\dots\dots\dots 3(x - 2)^2 + 7$$

(3)

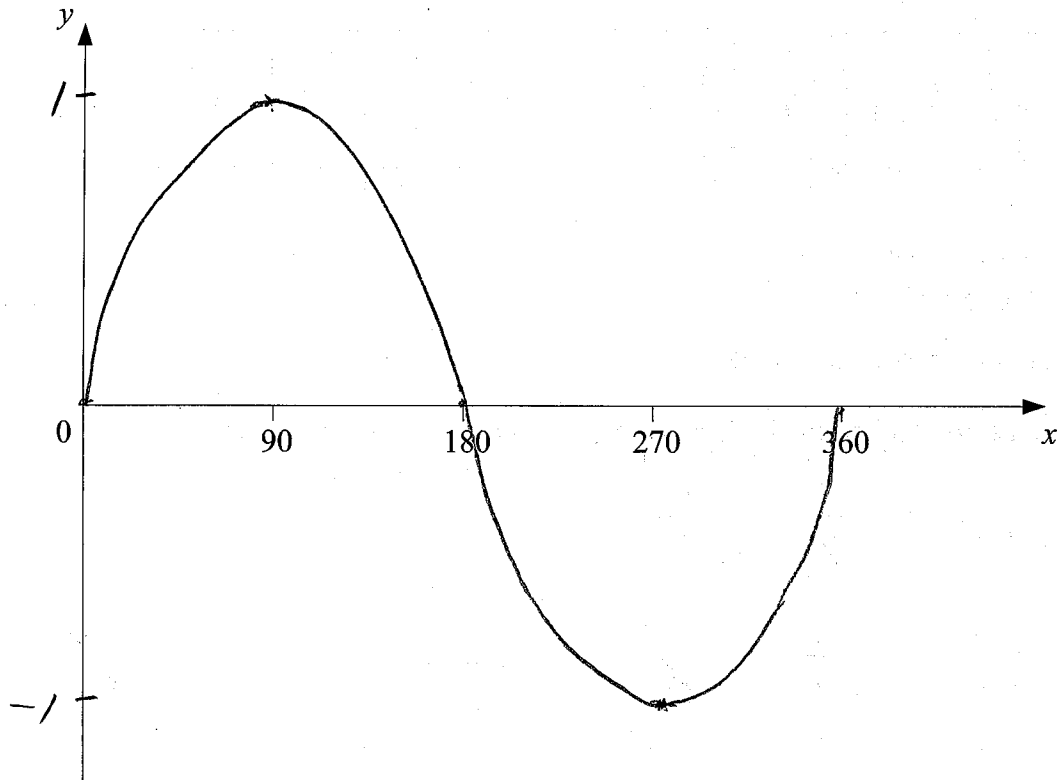
(b) Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 12x + 19$

(2, 7)

(1)

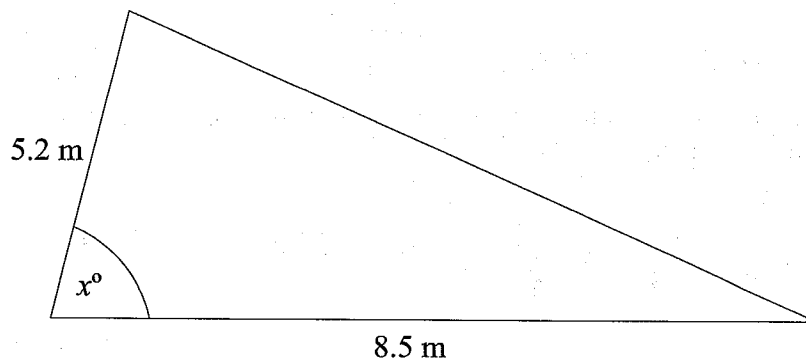
(Total for Question 5 is 4 marks)

6 Sketch the graph of $y = \sin x^\circ$ for $0 \leq x \leq 360$



(Total for Question 6 is 2 marks)

7



The area of the triangle is 22 m^2

Work out the value of x .

Give your answer to 3 significant figures.

$$\frac{1}{2} (5.2) (8.5) \sin x = 22$$

$$\sin x = \frac{22}{\frac{1}{2} (5.2) (8.5)}$$

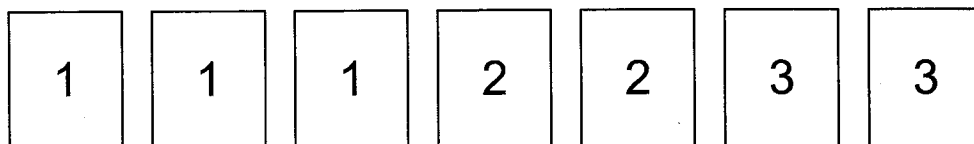
$$x = \sin^{-1} \left(\frac{220}{221} \right)$$

$$= 84.5$$

84.5°

(Total for Question 7 is 4 marks)

Here are seven number cards.



Helen takes a card at random.
She does not replace the card.

Helen then takes another card at random.

(a) Calculate the probability that both cards have the same number on them.

$$P(1, 1) = \frac{3}{7} \times \frac{2}{6} = \frac{6}{42}$$

$$P(2, 2) = \frac{2}{7} \times \frac{1}{6} = \frac{2}{42}$$

$$P(3, 3) = \frac{2}{7} \times \frac{1}{6} = \frac{2}{42}$$

$$\frac{6}{42} + \frac{2}{42} + \frac{2}{42}$$

$$\frac{10}{42}$$

$$\left(\text{OR } \frac{5}{21} \right) \quad (3)$$

(b) Calculate the probability that the number on the first card Helen takes and the number on the second card Helen takes have a sum of 4.

$$P(1, 3) = \frac{3}{7} \times \frac{2}{6} = \frac{6}{42}$$

$$P(2, 2) = \frac{2}{42}$$

$$P(3, 1) = \frac{2}{7} \times \frac{3}{6} = \frac{6}{42}$$

$$\frac{6}{42} + \frac{2}{42} + \frac{6}{42} = \frac{14}{42}$$

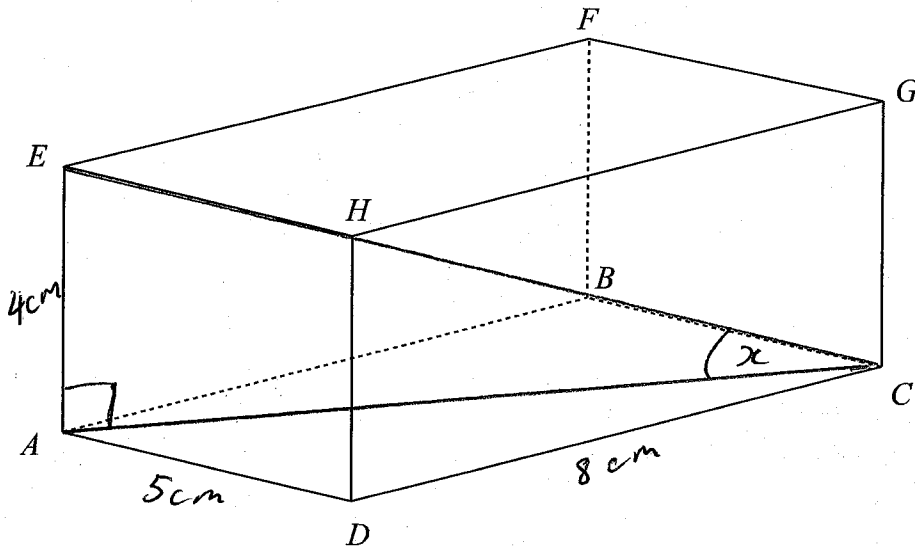
$$\frac{14}{42}$$

$$\left(\text{OR } \frac{1}{3} \right) \quad (3)$$

(Total for Question 8 is 6 marks)

9 The diagram shows a cuboid $ABCDEFGH$.

$AE = 4 \text{ cm}$
 $AD = 5 \text{ cm}$
 $DC = 8 \text{ cm}$



Calculate the size of angle ECA .
 Give your answer correct to 3 significant figures.

$$AD^2 + CD^2 = AC^2$$

$$5^2 + 8^2 = AC^2$$

$$AC = \sqrt{5^2 + 8^2}$$

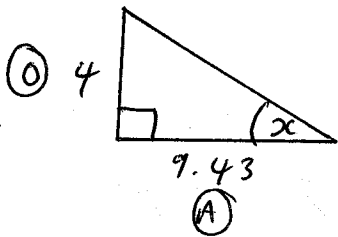
$$= 9.43398\dots$$

$$\tan x = \frac{4}{9.43398}$$

$$x = \tan^{-1}\left(\frac{4}{9.43398}\right)$$

$$= 22.9769$$

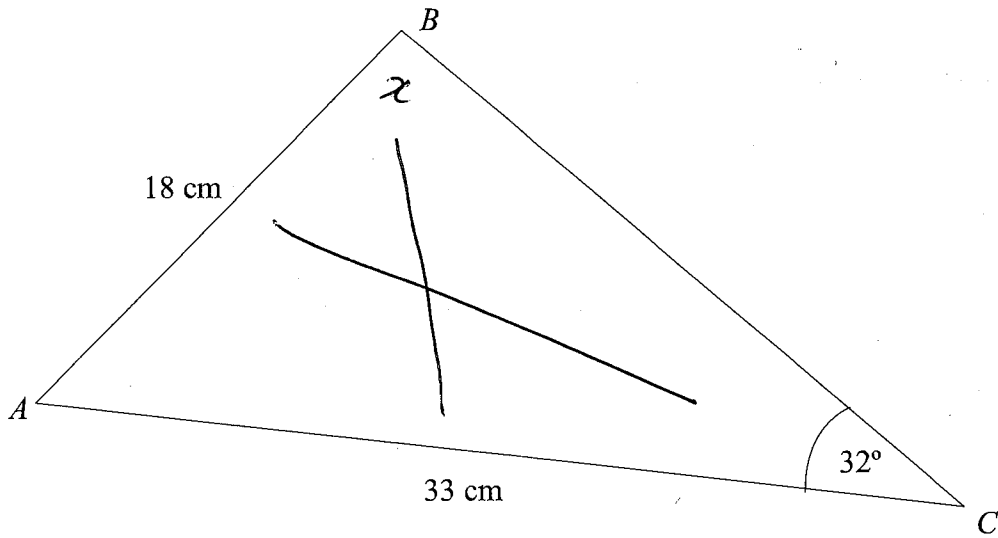
$$= 23.0$$



23.0 °

(Total for Question 9 is 4 marks)

10



Angle ABC is obtuse.

Work out the size of angle ABC .

Give your answer to 3 significant figures.

$$\frac{\sin x}{33} = \frac{\sin 32}{18}$$

$$\sin x = \frac{\sin 32}{18} \times 33$$

$$= 0.97151\dots$$

$$x = \sin^{-1}(\text{Ans})$$

$$= 76.29$$

$$x \text{ is obtuse } \therefore x = 180 - 76.29$$

$$= 103.707$$

$$= 104$$

$$\underline{\underline{104^\circ}}$$

(Total for Question 10 is 4 marks)