Name: _____

# Maths Genie Stage 13

# Test D

**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**

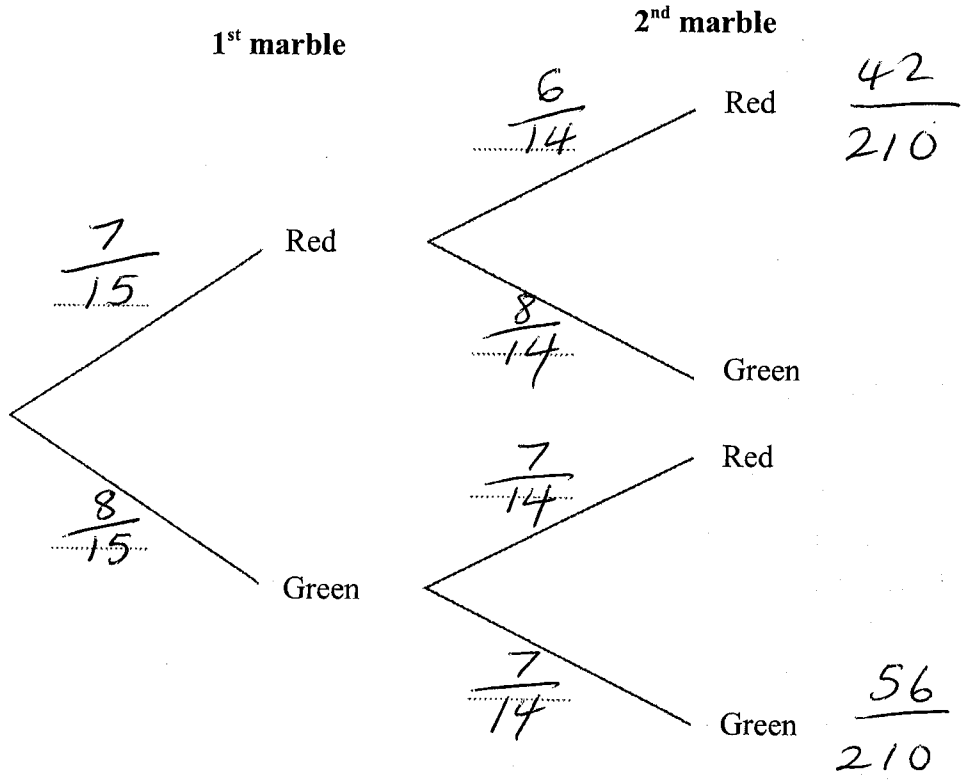
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

**1** There are only red marbles and green marbles in a bag.
There are 7 red marbles and 8 green marbles.

Mason takes at random a marble from the bag.
He does not put the marble back in the bag.

Mason takes at random a second marble from the bag.

(a) Complete the probability tree diagram.




(2)

(b) Work out the probability that Mason takes two marbles the same colour.

$\frac{7}{15} \times \frac{6}{14} = \frac{42}{210}$

$\frac{8}{15} \times \frac{7}{14} = \frac{56}{210}$

$\frac{56}{210}$

(2)

**(Total for Question 1 is 4 marks)**

(OR $\frac{7}{15}$)

**2** By completing the square, find the coordinates of the turning point of the curve with the equation $y = x^2 + 8x - 3$
You must show all your working.

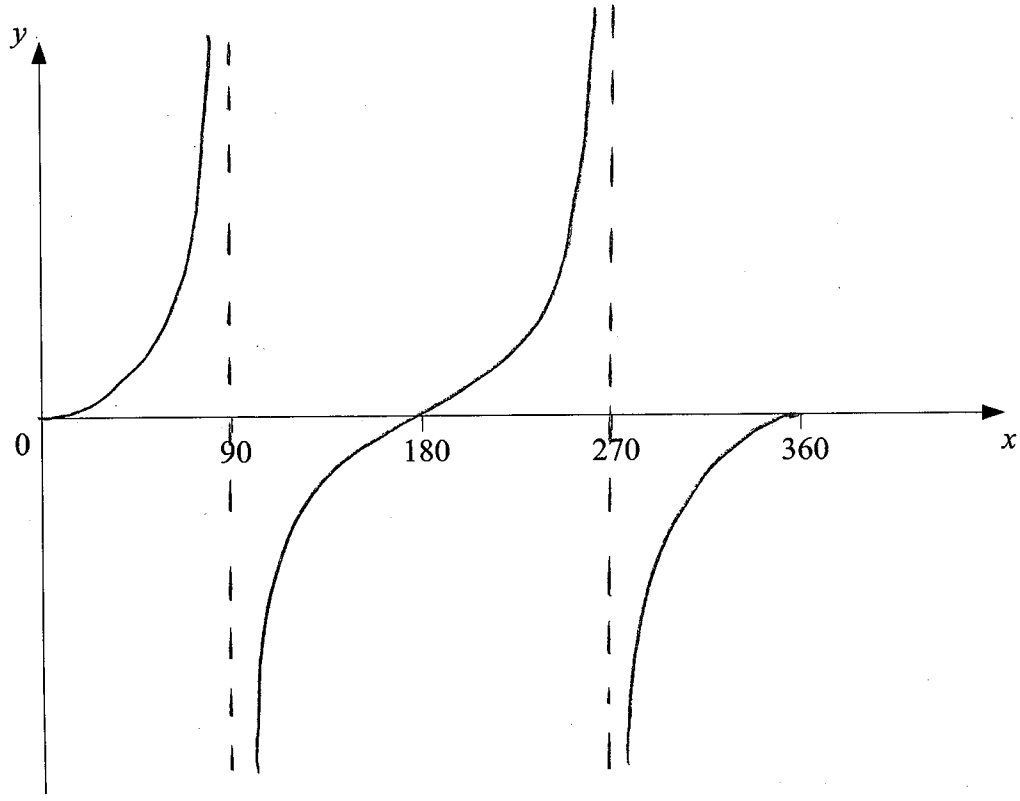
$(x + 4)^2 - 16 - 3$

$(x + 4)^2 - 19$

$(-4, -19)$

**(Total for Question 2 is 3 marks)**

**3** Sketch the graph of $y = \tan x°$ for $0 \leq x \leq 360$

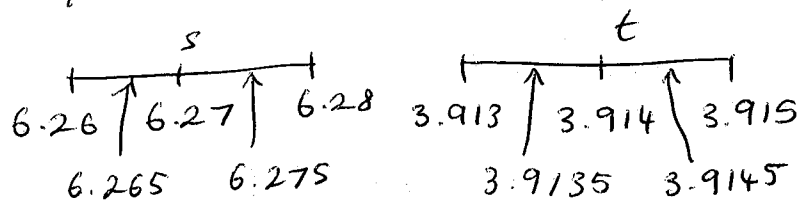



**(Total for Question 3 is 2 marks)**

**4** $v = \frac{s}{t}$

$s = 6.27$ correct to 2 decimal places
$t = 3.914$ correct to 3 decimal places

Work out the upper bound for v.
Give your answer to 3 decimal places.




$$\text{upper } v = \frac{\text{upper } s}{\text{lower } t}$$

$$= \frac{6.275}{3.9135}$$

$$= 1.603$$

1.603

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

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**5** Solve $\frac{4}{x-2} + \frac{2}{x-5} = 3$

$$4(x-5) + 2(x-2) = 3(x-2)(x-5)$$

$$4x - 20 + 2x - 4 = 3(x^2 - 5x - 2x + 10)$$

$$6x - 24 = 3(x^2 - 7x + 10)$$

$$6x - 24 = 3x^2 - 21x + 30$$

$$0 = 3x^2 - 27x + 54$$

$$0 = x^2 - 9x + 18$$

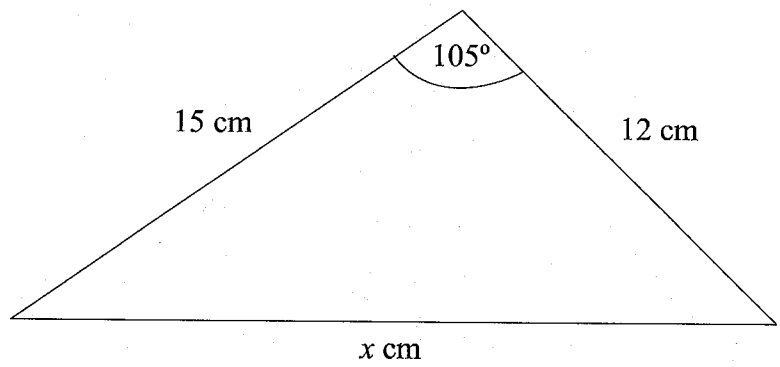
$$(x - 6)(x - 3) = 0$$

$x = 6$ $x = 3$

$x = 3$ or $x = 6$

**(Total for Question 5 is 4 marks)**

**6**




Work out the value of $x$.
Give your answer to 1 decimal place.

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$= 15^2 + 12^2 - 2(15)(12)\cos(105)$$
$$= 462.17...$$
$$a = \sqrt{462.17}$$
$$= 21.5$$

21.5

**(Total for Question 6 is 3 marks)**

**7** Prove that the difference between the squares of any 2 consecutive integers is equal to the sum of these integers.

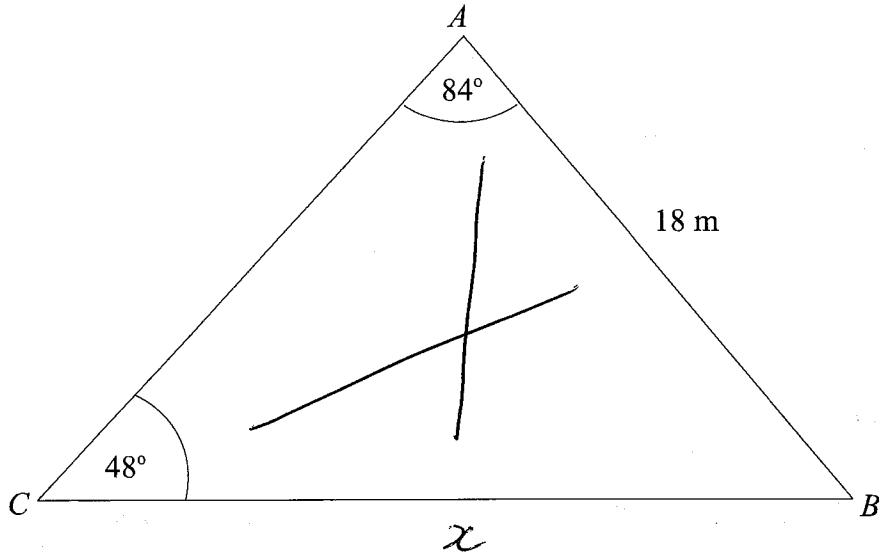
$$(n+1)^2 - n^2$$
$$(n+1)(n+1) - n^2$$
$$n^2 + n + n + 1 - n^2$$
$$2n + 1$$

$$n + (n+1)$$
$$2n + 1$$

$$2n + 1 = 2n + 1$$

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

**8**




Work out the area of triangle *ABC*

Give your answer to 1 decimal place.

$$\frac{x}{\sin 84} = \frac{18}{\sin 48}$$

$$x = \frac{18}{\sin 48} \times \sin 84$$

$$= 24.0887 \text{ m}$$

Angle $ABC = 180 - 48 - 84 = 48^\circ$

$$\text{Area} = \frac{1}{2}(18)(24.0887)\sin 48$$

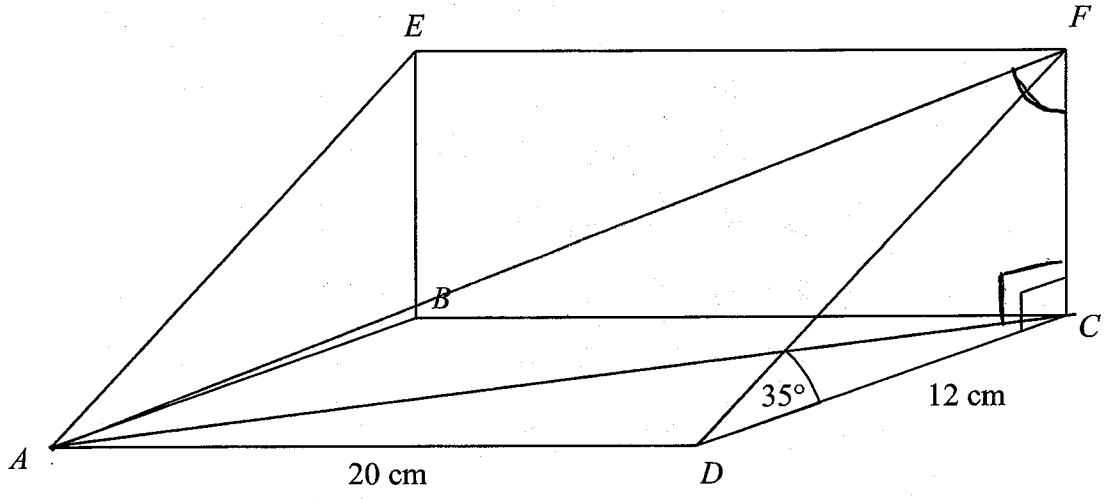
$$= 161.1 \text{ m}^2$$

161.1 ..... $m^2$

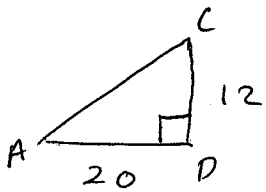
**(Total for Question 8 is 5 marks)**

**9** The diagram shows a triangular prism.

$CD = 12$ cm
$AD = 20$ cm
Angle $ADC = 35°$



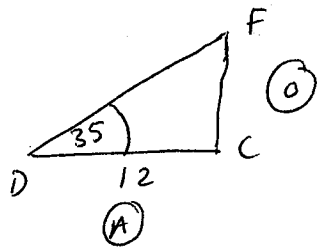

Calculate the size of angle $AFC$.
Give your answer correct to 1 decimal place.




$AC^2 = 12^2 + 20^2$

$AC = \sqrt{12^2 + 20^2}$

$= 4\sqrt{34}$



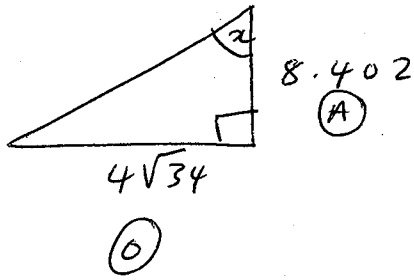

(O)

(A)

$\tan 35 = \frac{CF}{12}$

$CF = 12 \tan 35$

$= 8.402$




$\tan x = \frac{4\sqrt{34}}{8.402}$

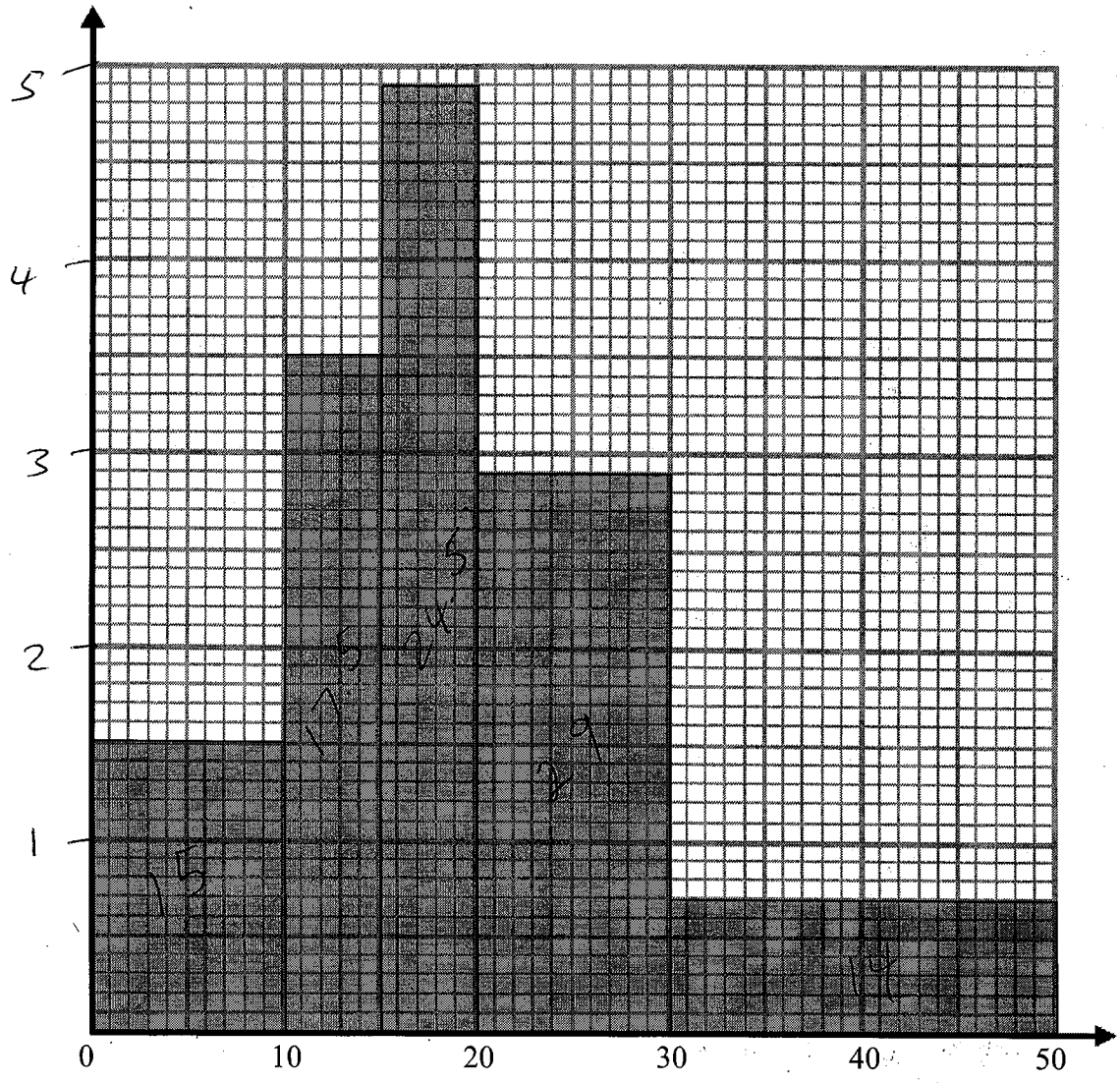
$x = \tan^{-1}(2.7758)$

$= 70.2°$

70.2 °

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

**10** The histogram shows information about the height of some plants.




(a) Work out an estimate for the proportion of plants over 25cm tall.

$15 + 17.5 + 24.5 + 29 + 14 = 100$

$\frac{29}{2} + 14 = 28.5$ $\quad \frac{28.5}{100} = \frac{57}{200}$ $\quad \frac{57}{200}$

(3)

(b) Explain why your answer to part a is only an estimate.

we do not know the exact heights of the plants we assumed the plants in the 20-30 cm group were evenly distributed.

(1)

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