Name: _____

GCSE (1 – 9)

3d Pythagoras and Trigonometry

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.**

Information

- The marks for each question are shown in brackets
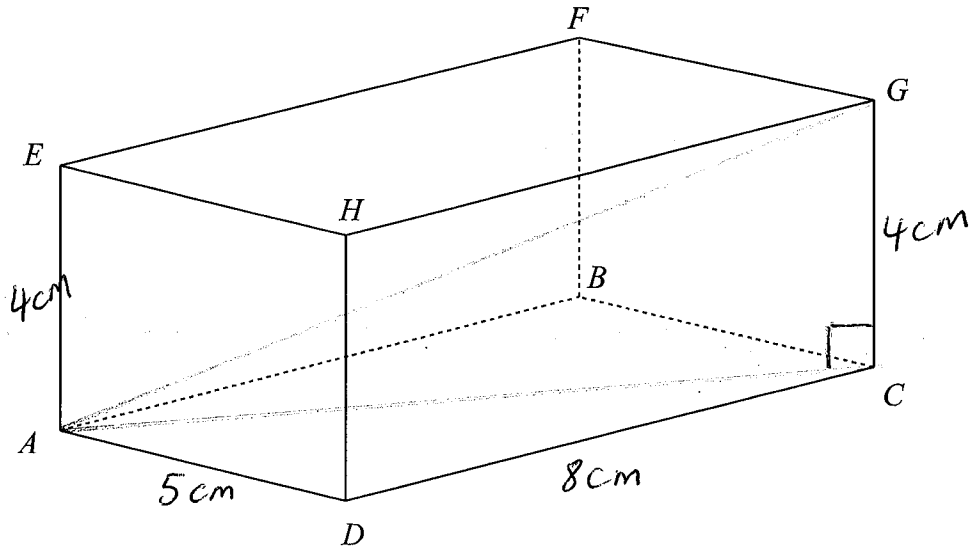 – *use this as a guide as to how much time to spend on each question.*

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 diagram shows a cuboid *ABCDEFGH*.

$AE = 4$ cm
$AD = 5$ cm
$DC = 8$ cm

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

$$AG^2 = 5^2 + 8^2 + 4^2$$

$$= \sqrt{5^2 + 8^2 + 4^2}$$

$$= 10.2 \text{ cm}$$

.......10.2....... cm

(Total for Question 1 is 3 marks)

2 The diagram shows a cuboid *ABCDEFGH*.

$AB = 5$ cm
$AE = 6$ cm
$AG = 12$ cm
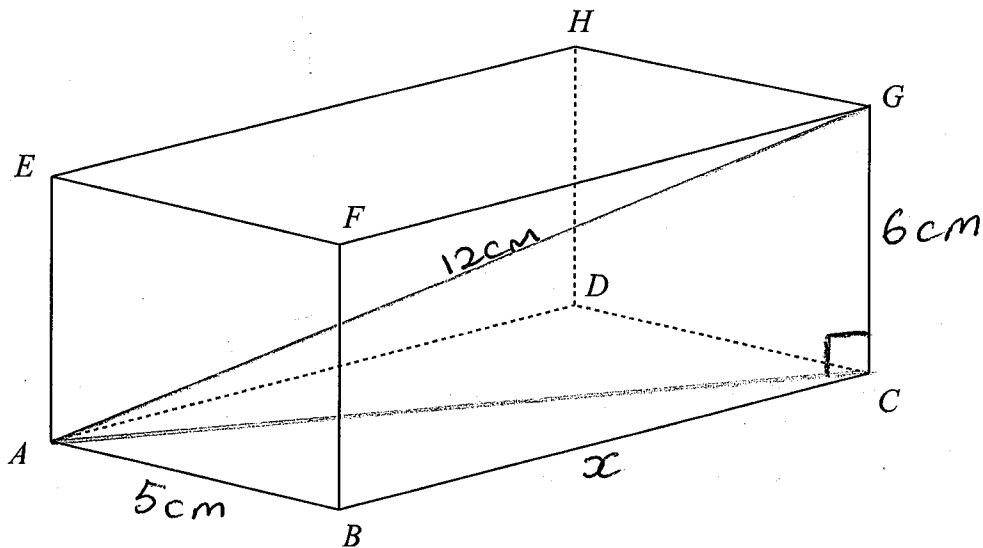
Calculate the length of *AD*.
Give your answer correct to 3 significant figures.

$$AC^2 + 6^2 = 12^2$$
$$AC^2 = 12^2 - 6^2$$
$$AC = \sqrt{12^2 - 6^2}$$
$$= 6\sqrt{3} \text{ cm}$$

$$5^2 + x^2 = \left(6\sqrt{3}\right)^2$$
$$x^2 = \left(6\sqrt{3}\right)^2 - 5^2$$
$$= 108 - 25$$
$$x = \sqrt{83}$$
$$= 9.11$$

............9.11............ cm

(Total for Question 2 is 4 marks)

3 The diagram shows a cuboid *ABCDEFGH*.
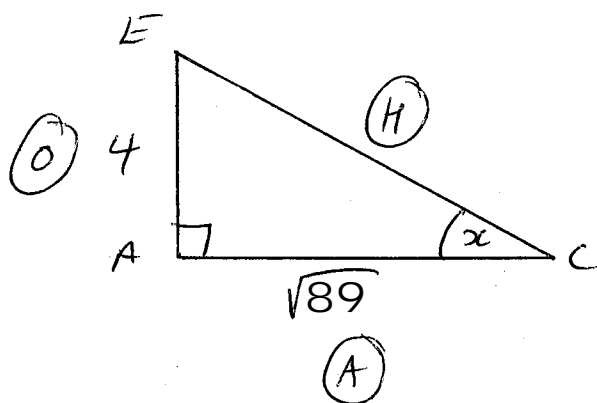
$AE = 4$ cm
$AD = 5$ cm
$DC = 8$ cm
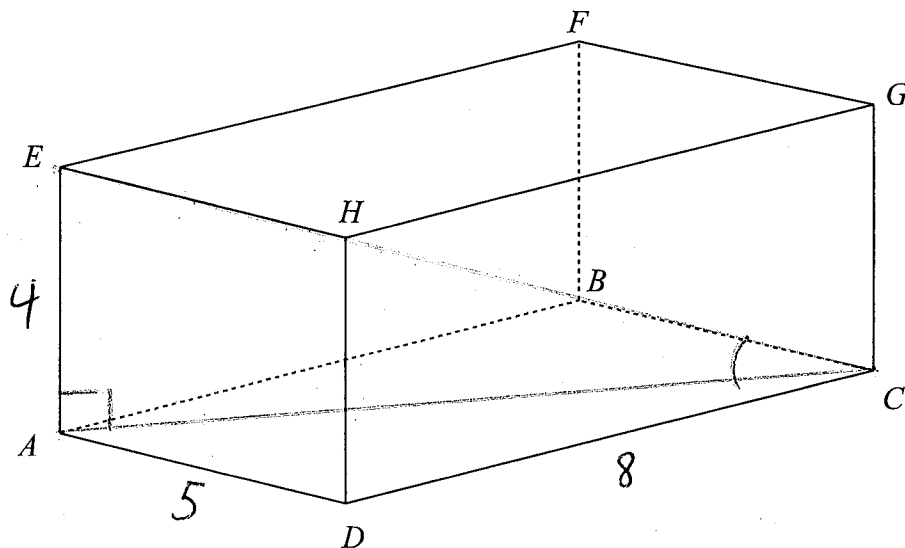
Calculate the size of angle *ECA*.
Give your answer correct to 3 significant figures.

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

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

$$= \sqrt{89}$$

$$\tan x = \frac{O}{A}$$

$$= \frac{4}{\sqrt{89}}$$
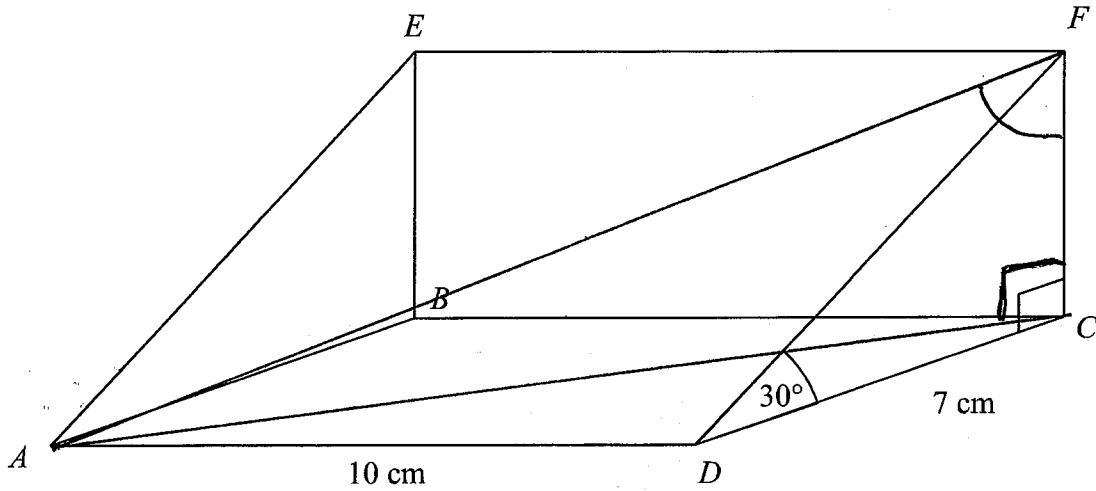
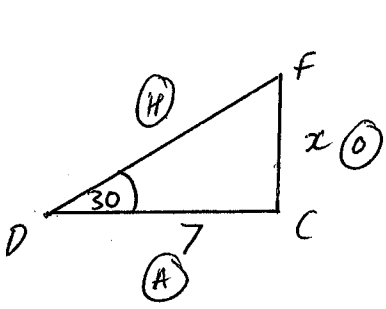$$x = \tan^{-1}\left(\frac{4}{\sqrt{89}}\right)$$

$$= 23.0°$$

23.0   °

(Total for Question 3 is 4 marks)

4   The diagram shows a triangular prism.

$CD = 7$ cm
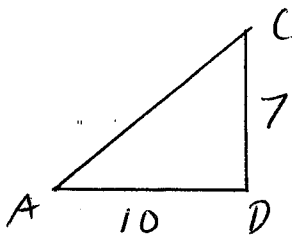$AD = 10$ cm
Angle $ADC = 30°$

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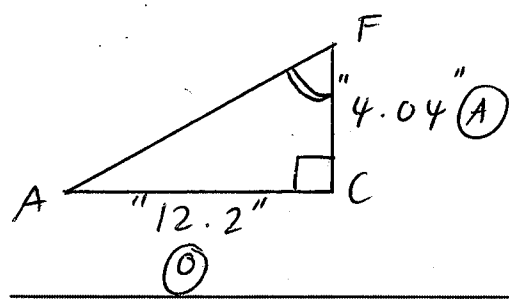

$$\tan 30 = \frac{x}{7}$$

$$x = 7 \tan 30$$
$$= 4.04145\ldots$$

$$AC^2 = 10^2 + 7^2$$
$$AC = \sqrt{10^2 + 7^2}$$
$$= 12.2065\ldots$$

$$\tan \theta = \frac{12.2}{4.04}$$

$$\theta = \tan^{-1}\left(\frac{12.2}{4.04}\right)$$
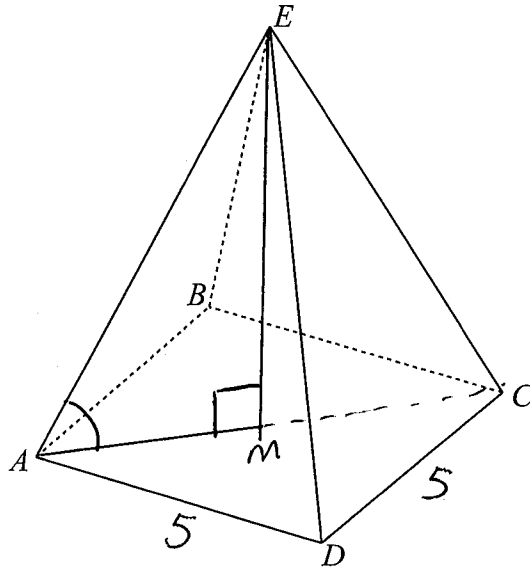
$$= 71.7$$

_____ 71.7 _____ °

(Total for Question 4 is 4 marks)

5 The diagram shows a pyramid.
The base of the pyramid *ABCD* is a square.

AB = 5 cm
The point *E* is 10 cm vertically above the base.
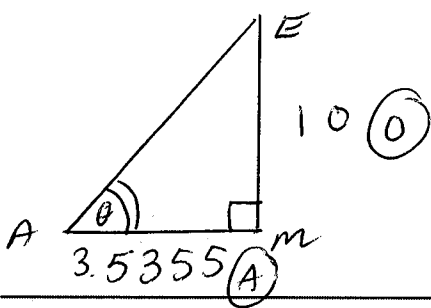

Calculate the size of angle *EAC*.

$$AC^2 = 5^2 + 5^2$$
$$AC = \sqrt{5^2 + 5^2}$$
$$= 7.07106\ldots$$

$$AM = \frac{7.07106}{2}$$
$$= 3.5355$$

$$\tan\theta = \frac{10}{3.5355}$$
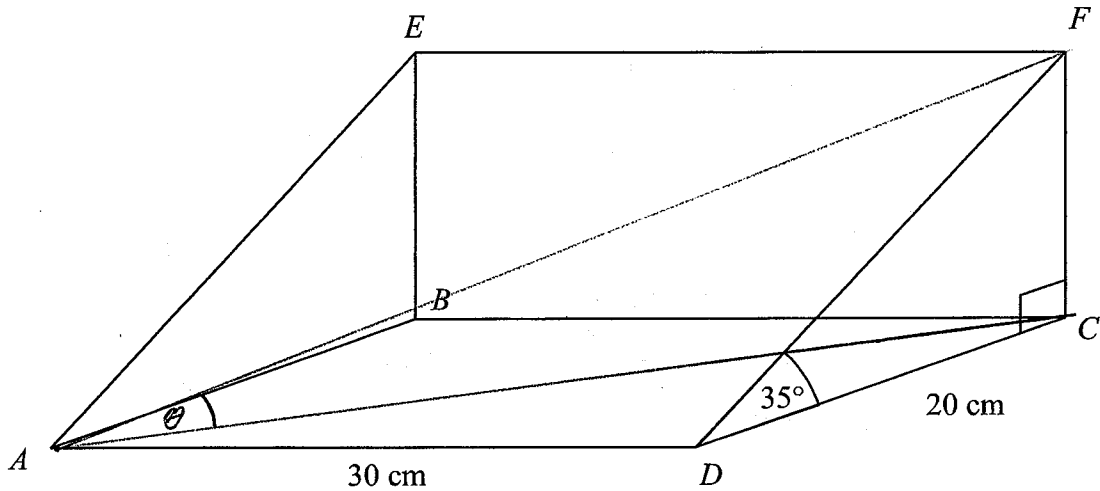$$\theta = \tan^{-1}\left(\frac{10}{3.5355}\right)$$
$$= 70.5$$

.... 70.5 °

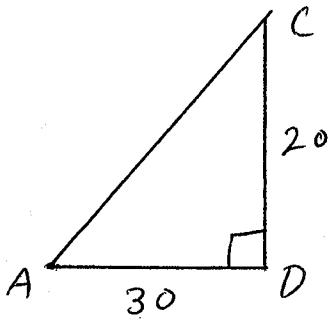(Total for Question 5 is 4 marks)

6 The diagram shows a triangular prism.
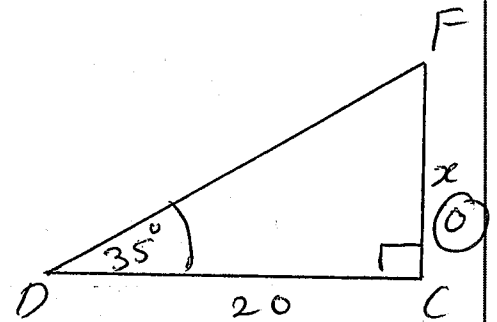
$CD = 20$ cm
$AD = 30$ cm
Angle $ADC = 35°$

Calculate the size of angle the line AF makes with the plane $ABCD$.
Give your answer correct to 3 significant figures.

$AC^2 = 30^2 + 20^2$
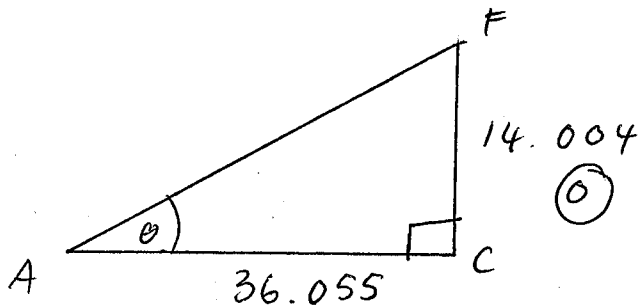
$AC = \sqrt{30^2 + 20^2}$

$= 36.0555$ cm

$\tan 35 = \dfrac{x}{20}$

$x = 20 \tan 35$

$= 14.004$

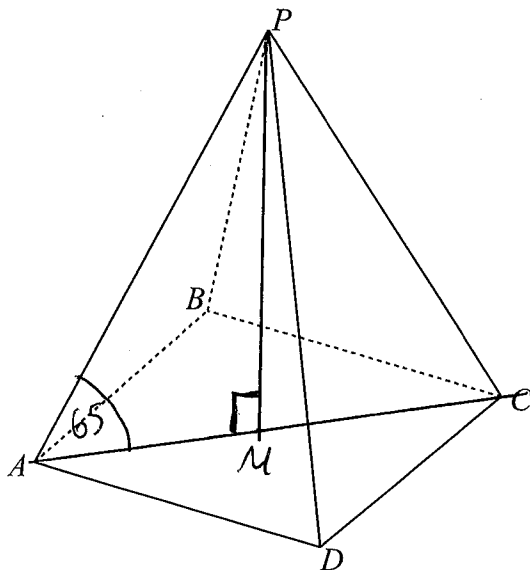$\tan \theta = \dfrac{14.004}{36.055}$

$= 21.2°$

_____ 21.2 °

(Total for Question 6 is 4 marks)

7 The diagram shows a pyramid.
The base of the pyramid $ABCD$ is a square.

$AB = 15$ cm
Angle $PAC = 65°$

Calculate the volume of the pyramid.

$$\text{volume} = \frac{1}{3}\binom{\text{base}}{\text{area}} \times \text{height}$$
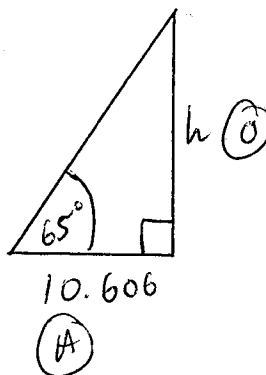
$$AC^2 = 15^2 + 15^2$$
$$AC = \sqrt{15^2 + 15^2}$$
$$= 15\sqrt{2}\ cm$$

$$AM = \frac{15\sqrt{2}}{2}$$
$$= 10.606\ cm$$

$$\tan 65 = \frac{h}{10.606}$$
$$h = 10.6 \tan 65$$
$$= 22.7459\ldots\ cm$$

Area of base $= 15 \times 15$
$$= 225\ cm^2$$

$$\text{Volume} = \frac{1}{3}(225)(22.7)$$
$$= 1706$$

$\underline{1706}$ cm³

(Total for Question 7 is 5 marks)