OCR H Nov'24 P6 -Calc

1 Sasha has these two sets of number cards.

Set A: 1 2 3 4 Set B: 8 9 10

One card is taken at random from each set.
Sasha adds the numbers on the two cards to get a total.

(a) Complete the table to show all the possible totals.

Set A

Set B	Total	1	2	3	4
	8	9	10	11	12
	9	10	11	12	13
	10	11	12	13	14

✓✓all
✓3+

[2]

(b) Find the probability that the total is a prime number.
Give your answer as a fraction.

(b) $\frac{5}{12}$ ✓✓ ..... **[2]**

2 The price of a holiday increases from £320 to £340.

Work out the percentage increase in the price of the holiday.

✓ $\frac{20}{320} \times 100$ ✓

6·25 ✓ ..... % **[3]**

3 A bag contains only blue, green and red counters in the ratio 7 : 3 : 2.
There are 76 more blue counters than green counters in the bag.

Work out the **total** number of counters in the bag.

B G R
7 3 2
4

76 ÷ 4 = 19 ✓

(7+3+2) x 19 ✓✓ OE.

= 228 ✓

..... [4]

4 A farmer has 60 pear trees.
The table shows the heights, h metres, of the pear trees.

Height (h metres)	Frequency	x	fx
$1 < h \leqslant 2$	5	1.5	7.5
$2 < h \leqslant 3$	8	2.5	20
$3 < h \leqslant 4$	32	3.5	112
$4 < h \leqslant 5$	15	4.5 ✓	67.5 ✓

(a) Calculate an estimate of the mean height of the 60 pear trees. $\Sigma = 207$

207 ÷ 60 ✓

(a) 3.45 ✓ m **[4]**

(b) Explain why it is not possible to use the information from this table to calculate the **exact** value of the mean height.

Exact heights are unknown ✓

..... **[1]**

5 Rearrange this formula to make f the subject.

$e = \frac{k}{f}$

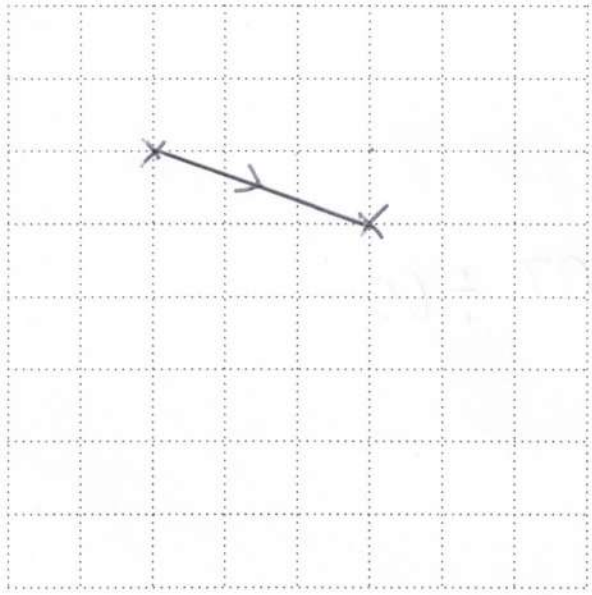
$e \times f = k$ ✓

$f = \frac{k}{e}$ ✓

..... **[2]**

6 $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$.

(a) On the grid below, draw $\overrightarrow{AB}$.



✓✓

✓no arrow

[2]

(b) Work out $\overrightarrow{AC}$.

$\begin{bmatrix} 3 \\ -1 \end{bmatrix} + \begin{bmatrix} 2 \\ 6 \end{bmatrix}$

$\begin{pmatrix} 5 \\ 5 \end{pmatrix}$ **[2]** ✓✓

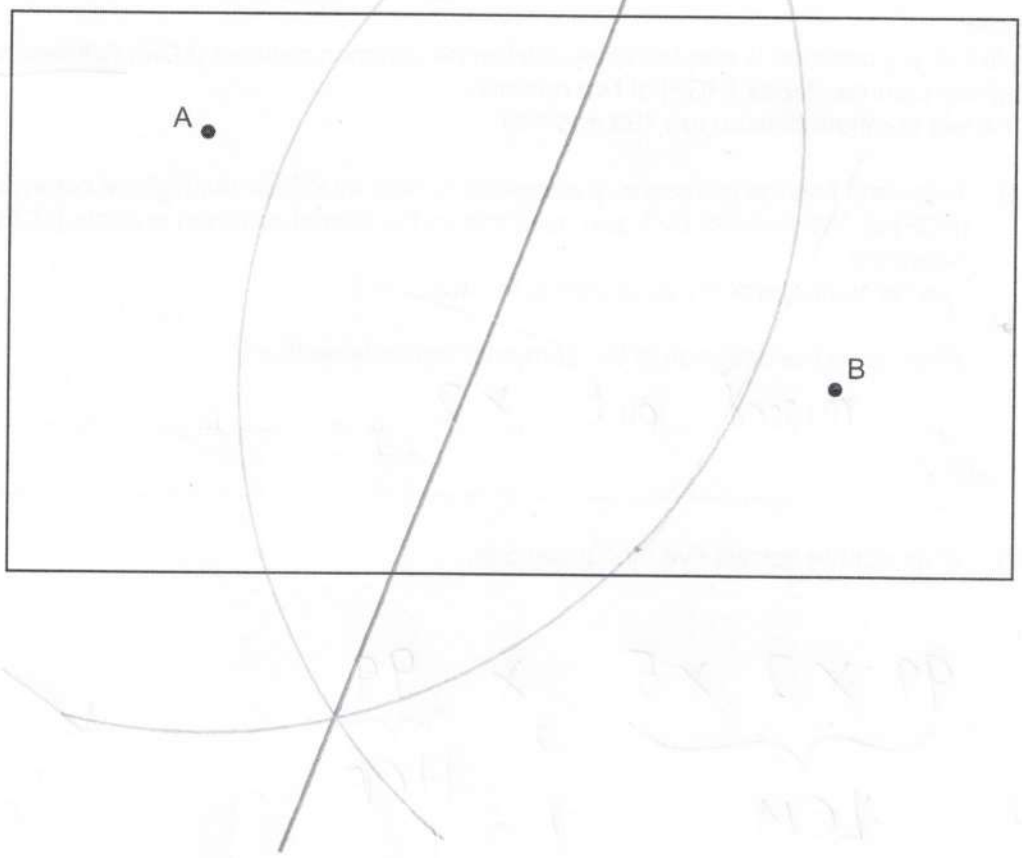
(c) Write down $\overrightarrow{BA}$.

$\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ **[1]** ✓

7 The diagram represents a rectangular field.
A and B are two trees.

A straight path goes across the field.
The path is always the same distance from A and B.

Construct the route followed by the path.
Show all your construction lines.



√√

√ no arcs

[2]

8 **(a)** 198 and 495 are written below as the product of their prime factors.

$198 = 2 \times 3^2 \times 11$ $\quad 495 = 3^2 \times 5 \times 11$

Work out the highest common factor (HCF) of 198 and 495.

HCF = $3^2 \times 11$ ✓

(a) 99 ✓ **[2]**

(b) A five-digit passcode is created using the lowest common multiple (LCM) followed by the highest common factor (HCF) of two numbers.
The two numbers chosen are 198 and 495.

(i) To try and find the passcode, a computer hacker multiplies the highest common factor (HCF) of 198 and 495 by 5 and uses this as the lowest common multiple (LCM) in the passcode.
The computer hacker's passcode is incorrect.

Write down the omission in the computer hacker's method.

missed out $\times 2$

[1]

(ii) Work out the correct five-digit passcode.

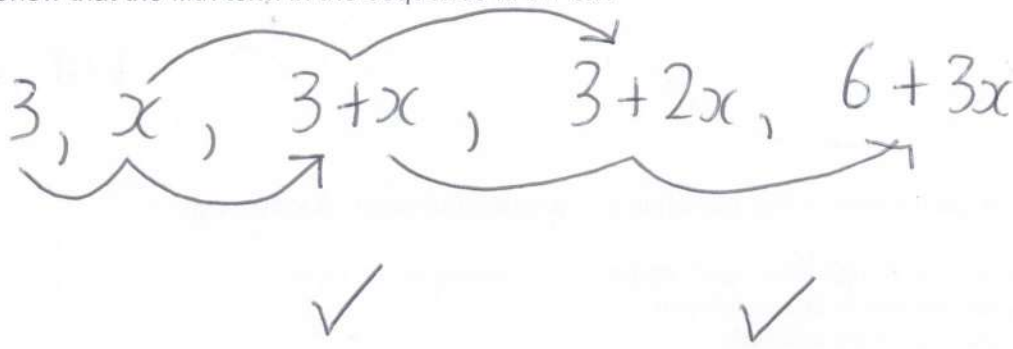
99 $\times$ 2 $\times$ 5 , 99 ✓
LCM , HCF

(ii) 99099 ✓ **[2]**

9 The next term in a Fibonacci sequence is found by adding together the previous two terms.

In a particular Fibonacci sequence:
- the first term is 3
- the second term is x.

(a) Show that the fifth term in the sequence is $6 + 3x$. **[2]**



✓ ✓

(b) The sixth term in the sequence is 74.

Find the value of x.

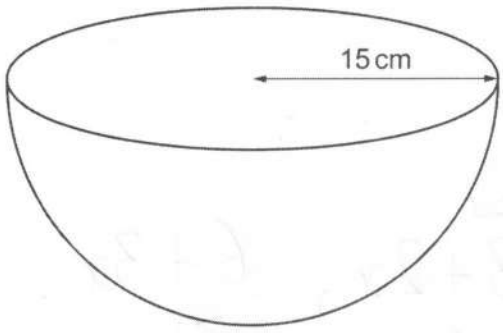
$9 + 5x = 74$ ✓✓

$5x = 65$ ✓

$x = \frac{65}{5}$

(b) $x =$ 13 ✓ **[4]**

10 A bowl in the shape of a hemisphere with radius 15 cm is used to collect raindrops.



Assume each raindrop has the volume of a sphere of radius 3×10^{-4} cm.

Calculate how many raindrops it takes to completely fill the bowl.
Give your answer in standard form.
You must show your working.

[The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$$\frac{\frac{1}{2} \times \frac{4}{3} \times \pi \times 15^3}{\frac{4}{3} \times \pi \times (3 \times 10^{-4})^3}$$

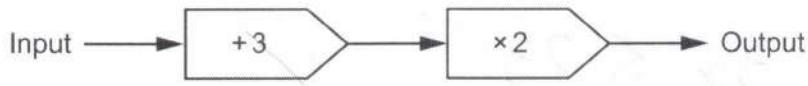
✓✓ ✓ ✓

✓ not in s.f.

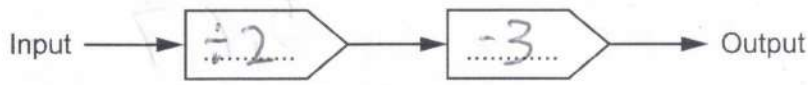
6.25×10^{13} ✓

..... **[6]**

11 **(a)** Here is a function.



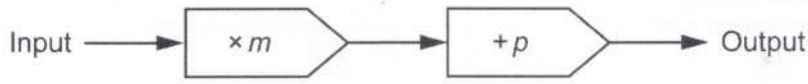
Complete the diagram below to show the **inverse** of the function.



✓ ✓

[2]

(b) Here is another function.



When the input is 5, the output is 8.5.
When the input is 10, the output is 11.

Find the value of m and the value of p.

$5m + p = 8.5$ ✓ $10m + p = 11$ ✓

$5m = 2.5$ ✓

$m = 0.5$ ✓

so $2.5 + p = 8.5$

$p = 8.5 - 2.5$

(b) $m =$ 0.5

$p =$ 6 ✓ **[5]**

12 **(a)** Find all the possible integer values of x that satisfy the inequality $10 < 3x - 2 \leqslant 21$.

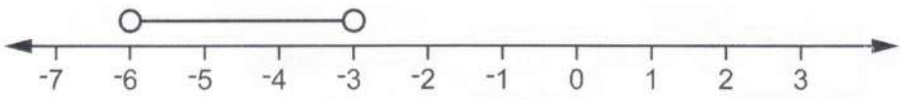
$12 < 3x \leqslant 23$ ✓

$4 < x \leqslant 7\frac{2}{3}$

5, 6, 7 ✓✓

(a) ..... **[3]**

(b) An inequality is shown on the number line below.



Taylor says,

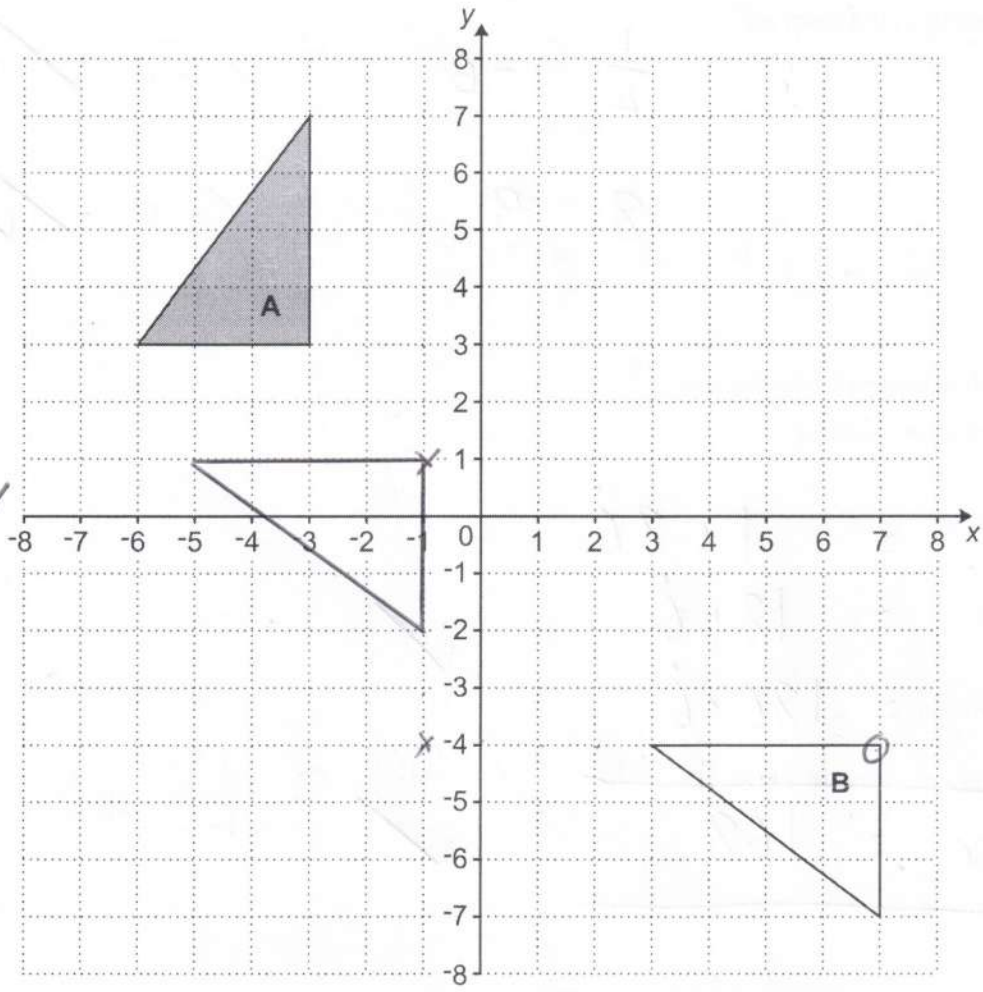
You can write this inequality as $\{x: -3 < x < -6\}$.

Explain why Taylor is **not** correct.

-6 is smaller than -3 ✓

..... **[1]**

13 Triangle **A** and triangle **B** are shown on the coordinate grid.



Triangle **A** is mapped onto triangle **B** using a combination of two transformations:

- a transformation T, followed by
- a translation of $\begin{pmatrix} 8 \\ -5 \end{pmatrix}$.

reverse $\Rightarrow \begin{bmatrix} -8 \\ 5 \end{bmatrix}$

Describe fully transformation T.

Rotation, 270 clockwise, around (-1, 3)

[4]

14 $N = 4a^6$.

Write the following in the form ka^m.

(a) $N^{-1} = \frac{1}{4} a^{-6}$ **[2]**

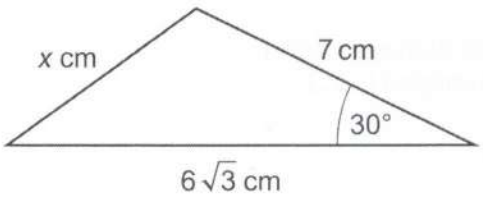
(b) $N^{\frac{3}{2}} = 8 a^{9}$ **[2]**

15 Prove that $1.8\dot{6}$ converts to the fraction $\frac{28}{15}$.
You must show your working. **[3]**

$$x = 1.8\dot{6}$$
$$10x = 18.\dot{6}$$
$$100x = 186.\dot{6}$$
$$90x = 168$$

$$x = \frac{168}{90} = \frac{28}{15}$$

16 Work out the exact value of x in this triangle.



Not to scale

$x^2 = 7^2 + (6\sqrt{3})^2 - 2 \times 7 \times 6\sqrt{3} \times \cos 30$ ✓✓

$x^2 = 49 + 108 - 14 \times 6\sqrt{3} \times \frac{\sqrt{3}}{2}$ ✓

$x^2 = 157 - 126$

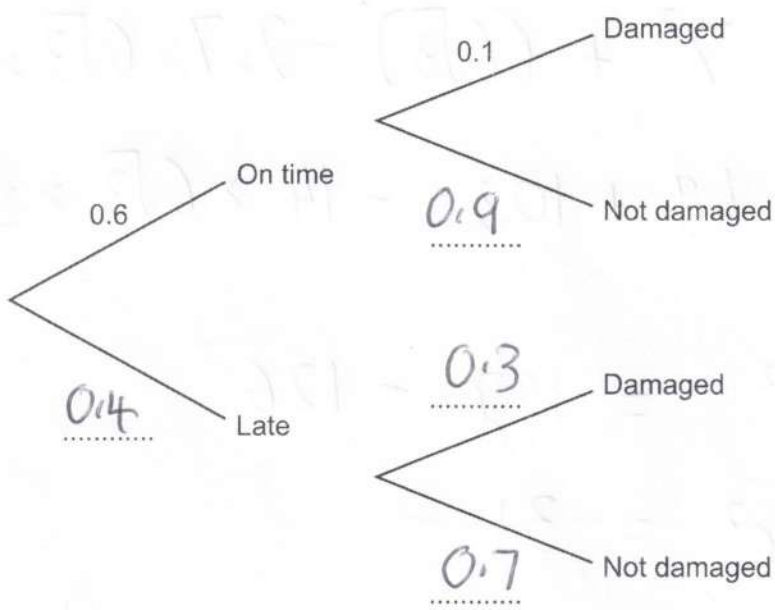
$x^2 = 31$

$x =$ $\sqrt{31}$ ✓ **[4]**

17 An online company is tracking the timing and condition of its deliveries.

The probability that a parcel arrives on time is 0.6.
When the parcel arrives on time, the probability that it is damaged is 0.1.
When the parcel arrives late, the probability that it is damaged is 0.3.

(a) Use the information to complete the tree diagram.



[3]

(b) Given that a parcel arrives damaged, find the probability that it also arrived on time.

D OT

$$P(OT/D) = \frac{P(OT \cap D)}{P(D)}$$

$$= \frac{0.6 \times 0.1}{(0.6 \times 0.1) + (0.4 \times 0.3)}$$

✓ ✓ ✓

$\frac{1}{3}$ ✓

(b) ..... **[4]**

18 y is inversely proportional to x^2.

Find the percentage decrease in y when x is increased by 25%. $x \rightarrow 1.25x$

$$y = \frac{k}{x^2} \quad \checkmark$$

$$\Rightarrow y = \frac{k}{(1.25x)^2} \quad \checkmark$$

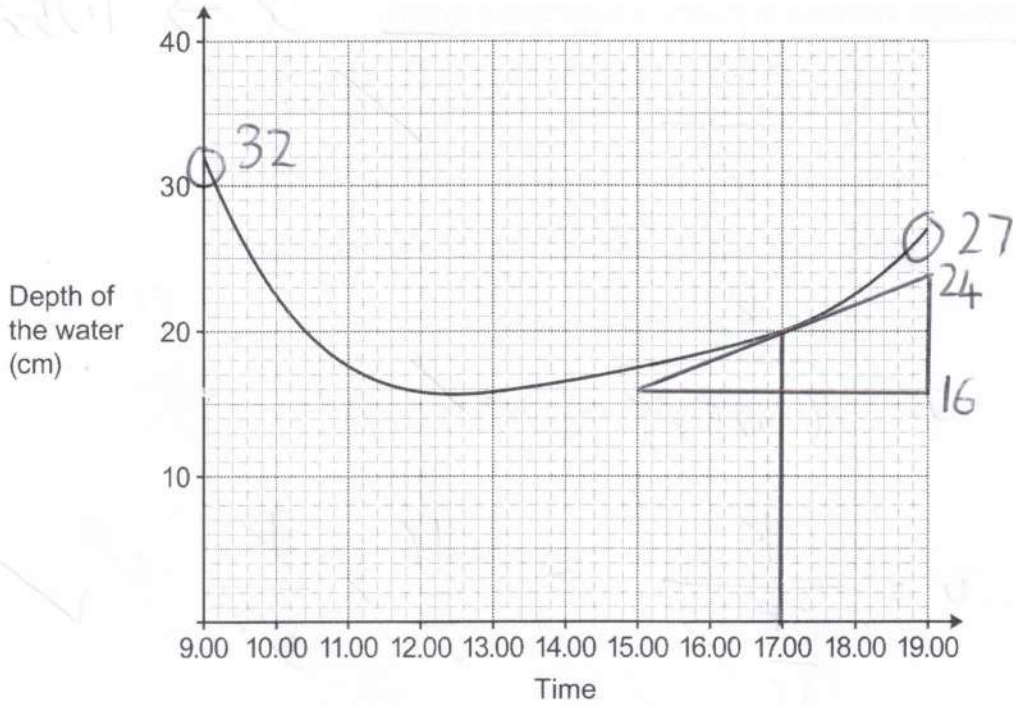
$$y = \frac{k}{\frac{25}{16}x^2} = \frac{16}{25} \times \frac{k}{x^2} \quad \checkmark$$

$$= 64\% \text{ of } \frac{k}{x^2}$$

36 ✓

..... % **[4]**

19 This graph shows the depth of the water, in centimetres, at a particular point in a river over a period of 10 hours.



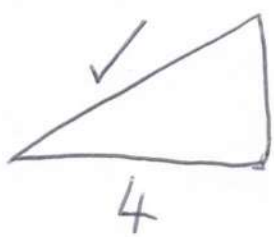
(a) Work out the average rate of change in the depth of the water over the 10 hours.

$\frac{32-27}{10}$ or $\frac{27-32}{10}$

± 0.5

(a) ..... cm per hour **[2]**

(b) Use the graph to estimate the rate of change in the depth of the water at 17.00.
You must show working to support your estimate.



$8 \div 4$

2

(b) ..... cm per hour **[4]**

[ms: 1.6 → 2]

20 $(4x + a)(4x - a)(x^2 + 2) = 16x^4 + bx^2 - 50$

Find the **two** possible pairs of values for a and b.
You must show your working.

$a \times -a \times 2 = -50$ ✓

$a^2 = 25$

$a = \pm 5$

$(4x \times 4x \times 2) + (-a \times a \times x^2) = bx^2$ ✓✓

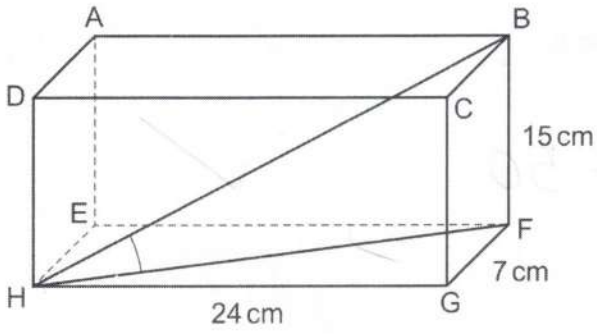
$32 + -25 = b$ ✓

$b = 7$

Pair 1: a = 5 and b = 7 ✓

Pair 2: a = -5 and b = 7 ✓ **[6]**

21 The diagram shows a cuboid ABCDEFGH.

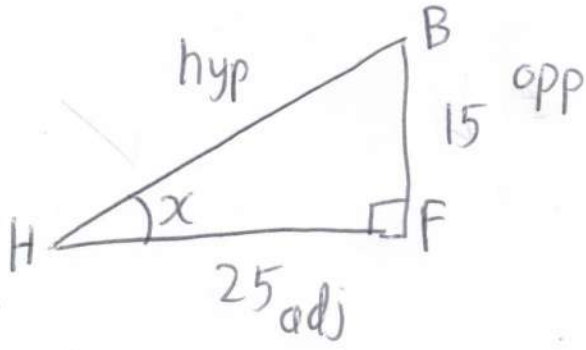


Not to scale

FB = 15 cm, GF = 7 cm and HG = 24 cm.

Calculate the angle BHF.
You must show your working.

$HF = \sqrt{24^2 + 7^2} = 25$ ✓✓



(T) O A

$x = \tan^{-1}\left(\frac{15}{25}\right)$ ✓✓

Angle BHF = 30.96 ✓ ..... ° **[5]**

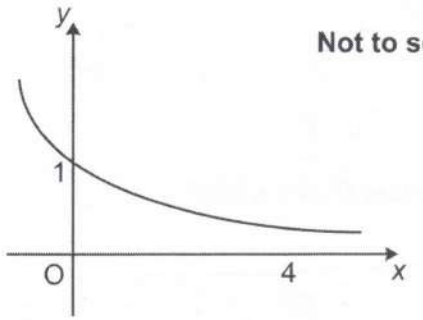
[ms: 30.9 → 31]

22 **(a)** For each graph below, select its possible equation from this list.

$y = \sqrt{x-4}$ $y = 4^x$ $y = x^4$ $y = \frac{4}{x}$

$y = \left(\frac{1}{4}\right)^x$ $y = -4x^2$ $y = 4\cos x$ $y = \sqrt{4^2 - x^2}$

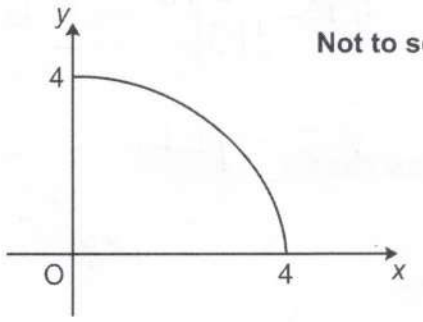
(i)



Not to scale

(a)(i) $y = \left(\frac{1}{4}\right)^x$ ✓ ..... **[1]**

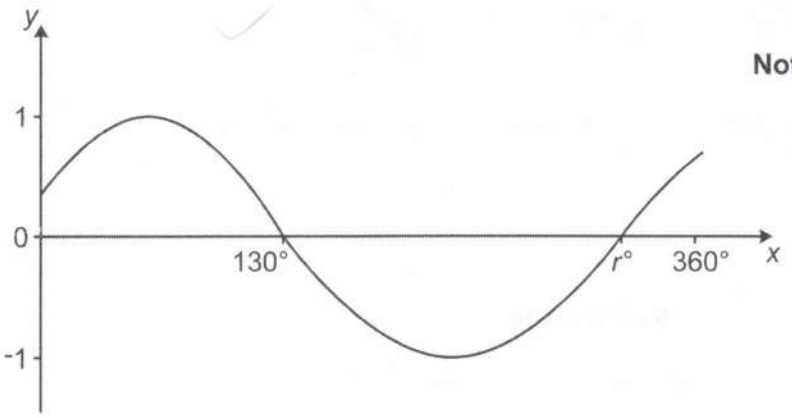
(ii)



Not to scale

(ii) $y = \sqrt{4^2 - x^2}$ ✓ ..... **[1]**

(b) A graph is drawn on the axes below.



Not to scale

The equation of the graph is $y = \sin(x + p)$, where $0° \leqslant x \leqslant 360°$.
The x-intercepts are 130° and $r°$.

Write down the value of p and the value of r.

$p =$ 50 ✓

$r =$ 310 ✓ **[2]**

END OF QUESTION PAPER