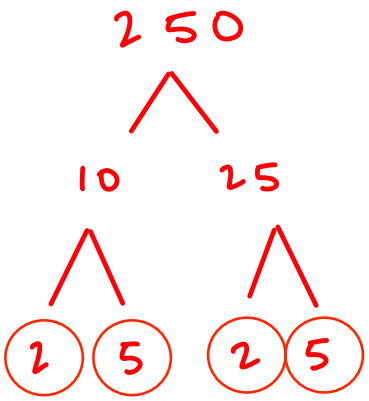
1 (a) Express 250 as a product of its prime factors.



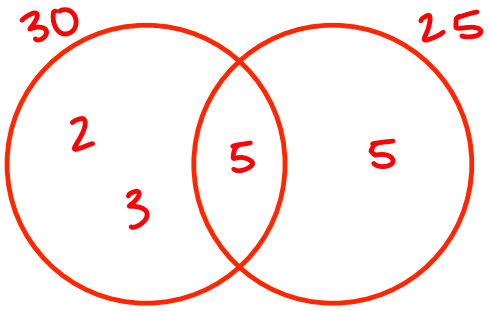
2×5^3

(2)

(b) Find the lowest common multiple (LCM) of 30 and 25

$30 = 2 \times 3 \times 5$

$25 = 5 \times 5$



LCM $= 2 \times 3 \times 5 \times 5$

150

(2)

(Total for Question 1 is 4 marks)

2 Sid, Tam and Musa share £6900 in the ratio 2 : 3 : 5 = 10 parts

Work out how much money each person receives.

6900 ÷ 10 = 690 (1 part)

690 x 2 = 1380

690 x 3 = 2070

690 x 5 = 3450

Sid £ 1380

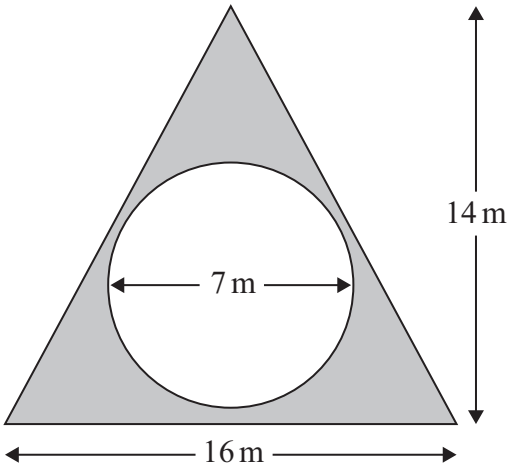
Tam £ 2070

Musa £ 3450

(Total for Question 2 is 3 marks)

3 Here is a plan of part of Macsen's garden.

There is a circle inside a triangle.
The circle has a diameter of 7 m.



Macsen will cover the shaded area with gravel.

Gravel is sold in bags.
Each bag of gravel covers an area of 12.5 m^2

(a) Work out the number of bags of gravel Macsen will need.

Tip: Shaded area = area of larger shape – area of smaller shape

Area of triangle = $\frac{16 \times 14}{2}$ = 112 m^2

Area of circle = $\pi \times 3.5^2$ = 38.485 m^2

112 - 38.485 = 73.52 m^2

73.52 ÷ 12.5 = 5.88...

6 bags needed!

6 ..... bags

(4)

Macsen finds that each bag of gravel only covers an area of $11\,m^2$

(b) How does this affect your answer to part (a)?

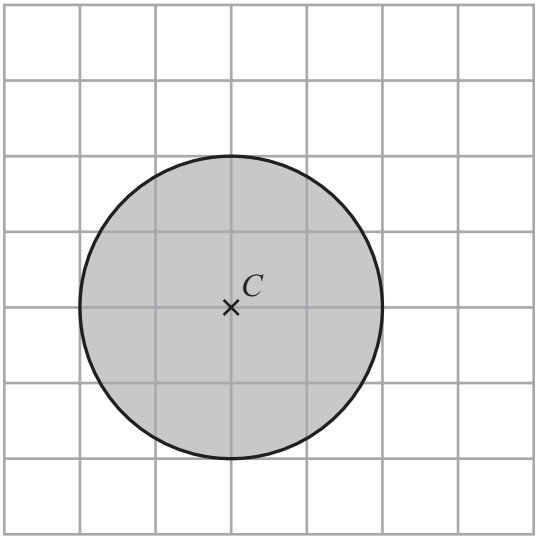
$73.52 \div 11 = 6.68$

He will need 7 bags

(1)

(Total for Question 3 is 5 marks)

4 The point C is shown on a centimetre grid.



A point P is at least 2 cm from the point C.
Nadia is asked to shade the region where point P could be.

Her answer is shown on the grid.

Explain the mistake Nadia has made.

She should have shaded the region outside of the circle

(Total for Question 4 is 1 mark)

5 This year the total weight of potatoes grown on a farm is $\frac{1}{5}$ less than last year.

This year the total weight of potatoes grown is 8000 tonnes.

Work out the total weight of potatoes grown last year.

$1 - \frac{1}{5} = \frac{4}{5}$

$\frac{4}{5} = 8000$ tonnes

$\div 4$

$\frac{1}{5} = 2000$ tonnes

$\times 5$

$\frac{5}{5} = 10,000$ tonnes

10,000 tonnes

(Total for Question 5 is 3 marks)

6 Here are two lists of numbers.

List **A** 276 400 157 139 = 972

List **B** 530 500 270 x 440 320 = 2430

mean of list **A** : mean of list **B** = 3 : 5

Work out the value of x.

Mean of A = 972 ÷ 4 = 243

A : B

3 : 5

x81 ↓ 243 : 405 ↓ x81

Mean of B = 405

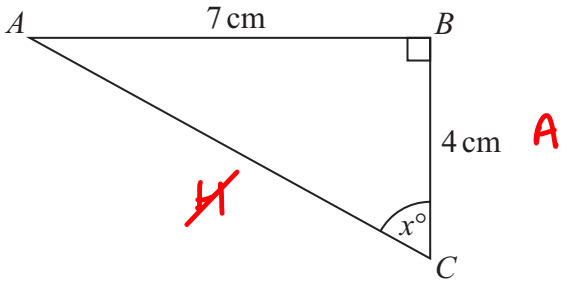
Total of B = 405 × 6 = 2430

2430 − 2060 = 370

$x =$ 370

(Total for Question 6 is 5 marks)

7 ABC is a right-angled triangle.



Calculate the value of x.
Give your answer correct to 1 decimal place.

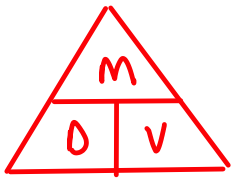
$x =$ .....

(Total for Question 7 is 2 marks)

8 Metal rods are made from steel with density 8 g/cm^3
Each metal rod has a volume of 1500 cm^3

The maximum mass of metal rods that can be put on a trolley is 300 kg.

Work out the greatest number of metal rods that can be put on the trolley.



$m = D \times V$

$= 8 \times 1500 = 12000\ g$

$= 12\ kg$

$300 \div 12 = 25$

25

(Total for Question 8 is 3 marks)

9 $3x^{-1}(4x - x^3) = a + bx^n$ for all the values of x that are not zero.

Find the value of a, the value of b and the value of n.

$3x^{-1}(4x^1 - x^3)$

$= 12x^0 - 3x^2$

$= 12 - 3x^2$

Tip: Any number to the power of 0 = 1

$a =$ 12

$b =$ -3

$n =$ 2

(Total for Question 9 is 2 marks)

10 Solve $\frac{14 - x}{3} = 3x$

$\times 3 \quad \times 3$

$14 - x = 9x$

$+x \quad +x$

$14 = 10x$

$\div 10 \quad \div 10$

$1.4 = x$

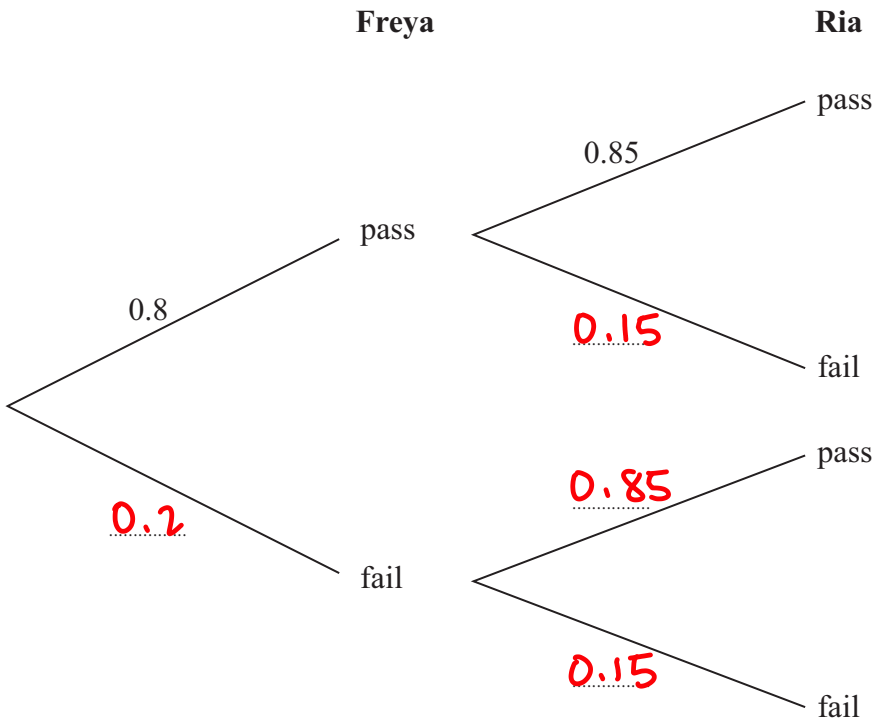
$x =$ 1.4

(Total for Question 10 is 2 marks)

11 Freya and Ria each do an exam.

The probability that Freya will pass the exam is 0.8
The probability that Ria will pass the exam is 0.85

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that only one of Freya or Ria will pass the exam.

P, F = 0.8 × 0.15 = 0.12 +

F, P = 0.2 × 0.85 = 0.17

0.29

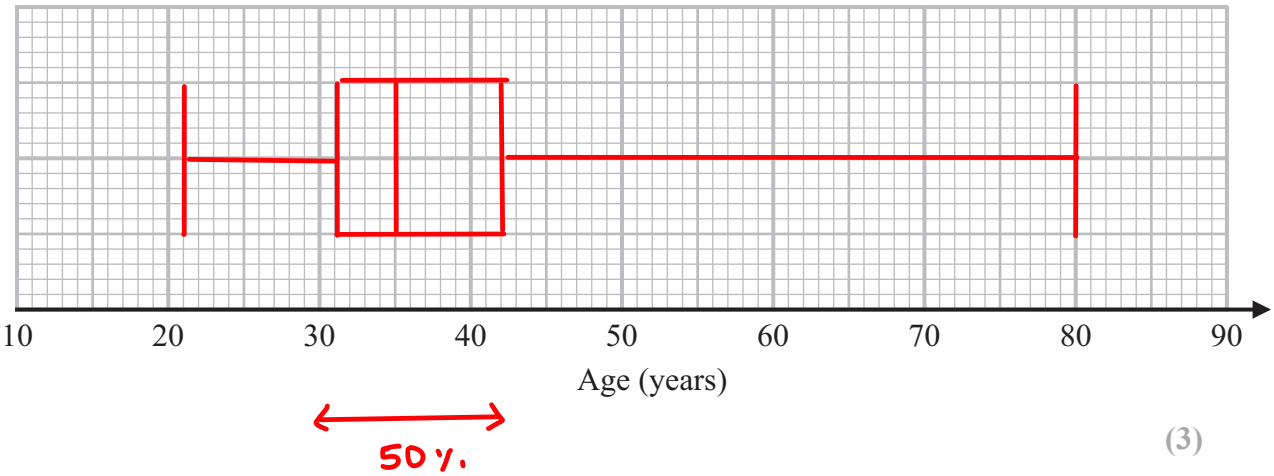
(3)

(Total for Question 11 is 5 marks)

12 The table gives some information about the ages, in years, of 32 actors.

Lowest age	21
Highest age	80
Lower quartile	31
Upper quartile	42
Median	35

(a) Draw a box plot to represent this information.



(3)

(b) Work out an estimate for the number of these actors with an age between 31 years and 42 years.

50% of 32 =

Tip: Each part of a bar chart represents 25%

16

(1)

Mary says,

"At least one of the actors is 35 years old because the median is 35"

(c) Is Mary correct?
Give a reason for your answer.

No, the median is not always one of the numbers in the data

(1)

(Total for Question 12 is 5 marks)

13 Show that $(2x + 3)(x - 1)(x + 2)$ can be written in the form

$ax^3 + bx^2 + cx + d$ where a, b, c and d are integers.

$(2x+3)(x-1) = 2x^2 - 2x + 3x - 3$

$= 2x^2 + x - 3$

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

$= 2x^3 + 4x^2 + x^2 + 2x - 3x - 6$

$= 2x^3 + 5x^2 - x - 6$

(Total for Question 13 is 3 marks)

14 There are 15 dogs in a dog show.
One dog is awarded first prize.
A different dog is awarded second prize.

There are 12 cats in a cat show.
One cat is awarded first prize.
A different cat is awarded second prize.

Work out how many different ways these four prizes can be awarded.

$15 \times 14 \times 12 \times 11$

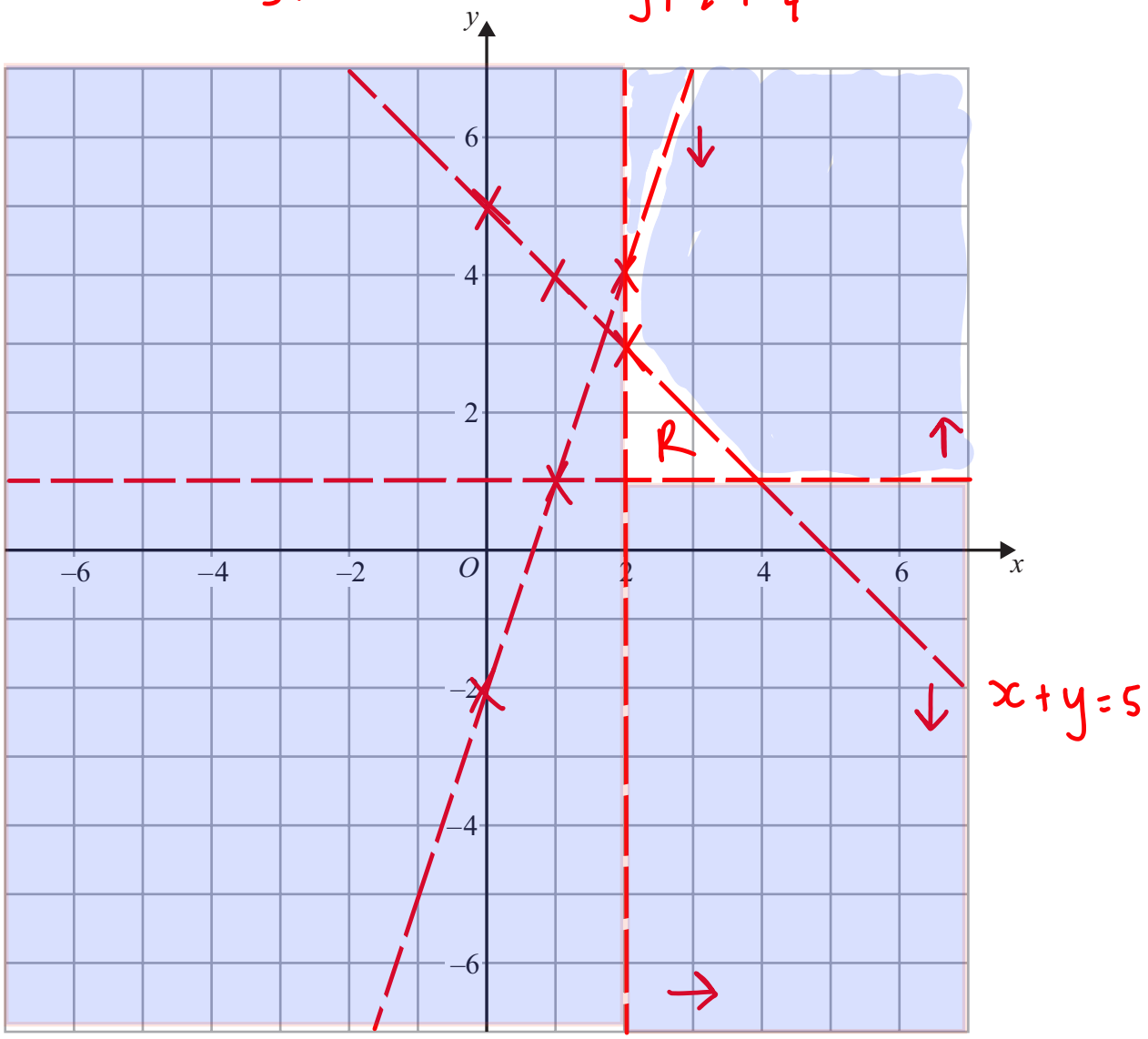
27720

(Total for Question 14 is 3 marks)

15 (a) On the grid, show by shading, the region that satisfies all of these inequalities.

$x + y < 5$ $y > 1$ $x > 2$ $y < 3x - 2$

Label the region **R**.



(4)

Ron says,

> "I can remove one of the four inequalities from the grid so that the region **R** will not change."

Ron is correct.

(b) Which inequality can be removed so that the region **R** will not change?

$y < 3x - 2$

(1)

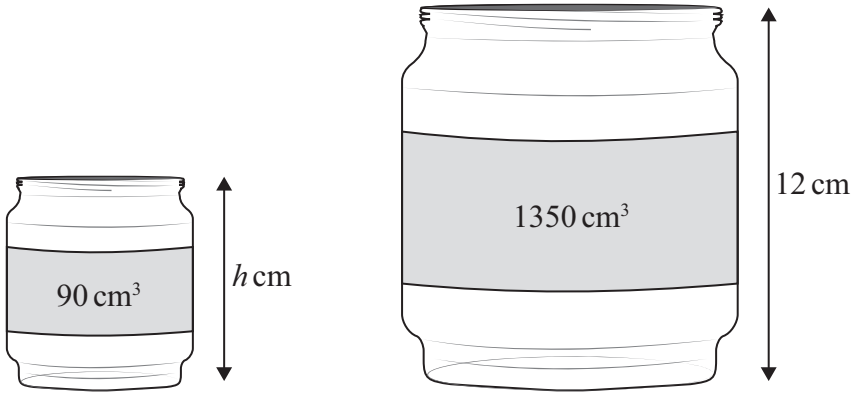
(Total for Question 15 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

16 Two jars are mathematically similar.



(a) Work out the height, h cm, of the smaller jar.
Give your answer correct to 1 decimal place.

LSF = $\sqrt[3]{15}$

ASF =

VSF = 1350 ÷ 90 = 15

12 ÷ $\sqrt[3]{15}$ = 4.8657..

4.9 cm

(4)

The surface area of the smaller jar is A cm^2
The surface area of the larger jar is pA cm^2

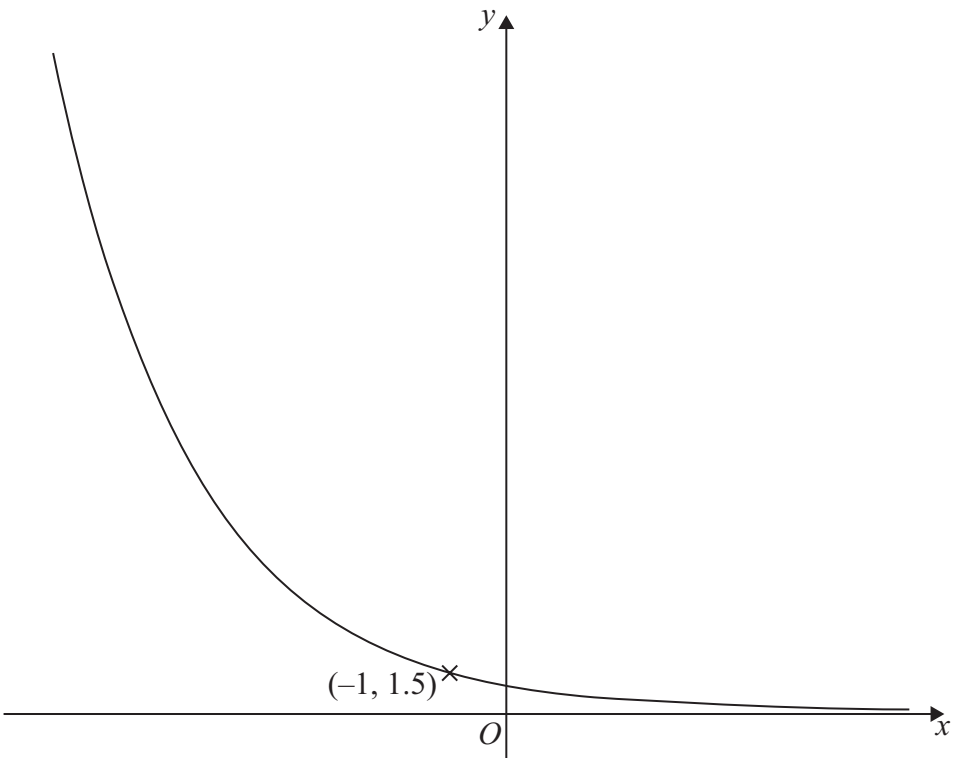
(b) Find the exact value of p.

$p =$ $(\sqrt[3]{15})^2$

(1)

(Total for Question 16 is 5 marks)

17 Here is a sketch of part of the graph of $y = k^x$ where k is a positive constant.



The graph passes through the point with coordinates (–1, 1.5)

Find the value of k.

x, y

$1.5 = k^{-1}$

$1.5 = \frac{1}{k}$

$\times k \quad \times k$

$1.5k = 1$

$\div 1.5 \quad \div 1.5$

$k = 0.\dot{6}$

$k =$ $0.\dot{6}$

(Total for Question 17 is 2 marks)

18 At the start of year n, the population of deer in a park is D_n
At the start of the following year, the population of the deer is D_{n+1}

$$D_{n+1} = K D_n \qquad \text{where } K \text{ is a constant.}$$

At the start of 2019, the population of the deer was 2000
At the start of 2020, the population of the deer was 2400

$D_{n+1} = 1.2 D_n$

Show that, at the start of 2022, the population of the deer was greater than 3000

(2019) $D_0 = 2000$

(2020) $D_1 = K(2000) = 2400$
$\div 2000 \quad \div 2000$
$K = 1.2$

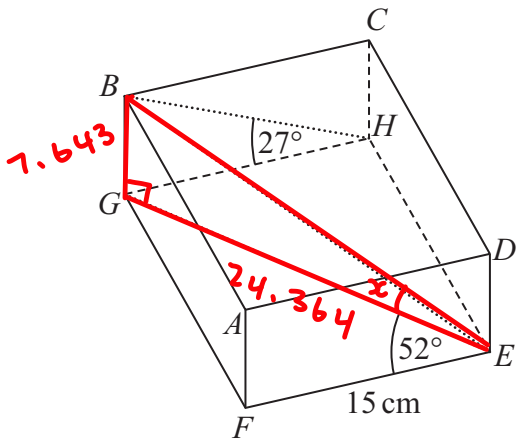
(2021) $D_3 = 1.2(2400) = 2880$

(2022) $D_4 = 1.2(2880) = 3456$

(Total for Question 18 is 3 marks)

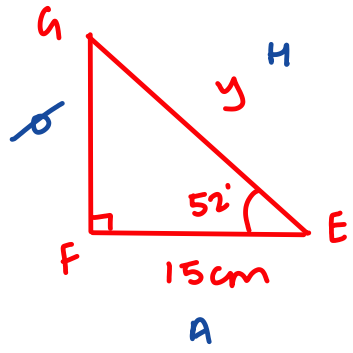
19 *ABCDEFGH* is a cuboid.

S°H C^AH T°A



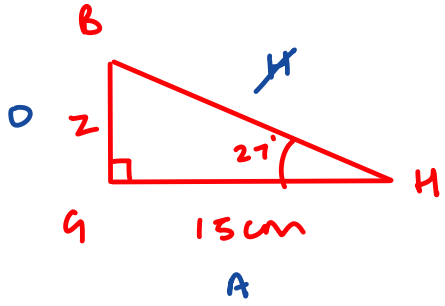
Angle *GEF* = 52°
Angle *BHG* = 27°
EF = 15 cm

Work out the size of angle *GEB*.
Give your answer to the nearest degree.



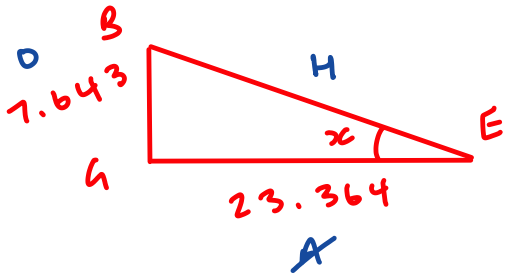
C^A

$\frac{15}{\cos(52)} = 24.364$



T^Ø A

Tan(27) × 15
= 7.643



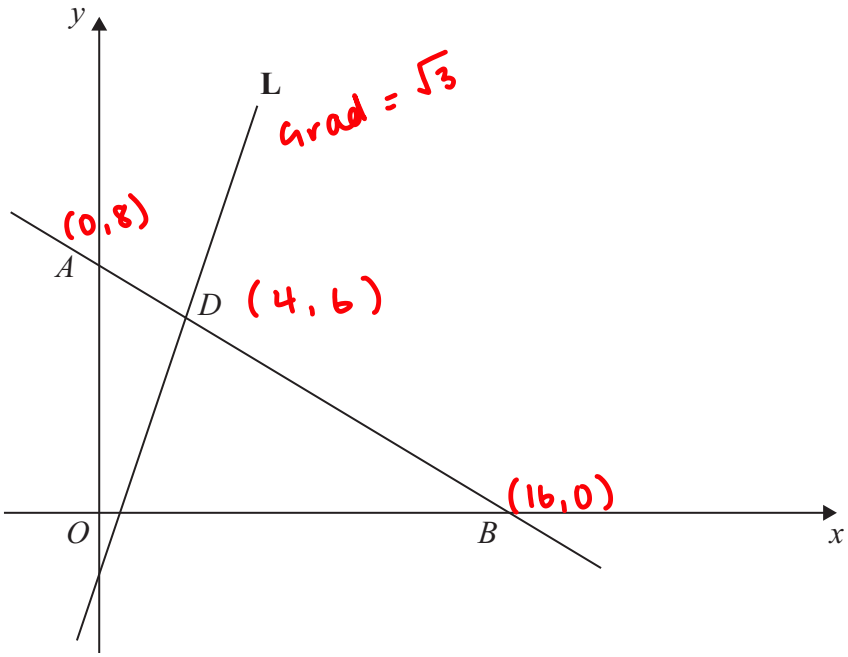
T^O A

$\tan^{-1}\left(\frac{7.643}{24.364}\right)$
=

17 °

(Total for Question 19 is 4 marks)

20



In the diagram
A is the point (0, 8)
B is the point (16, 0)

The point *D* divides the line segment *AB* in the ratio 1 : 3
The line **L** passes through *D*.
The gradient of **L** is $\sqrt{3}$

L passes through the point with coordinates $(-2, f)$
x, y

Show that $f < -4$

÷4 A to B (4 parts) = → 16 ↓ 8
A to D (1 part) = → 4 ↓ 2

D = (4, 6)

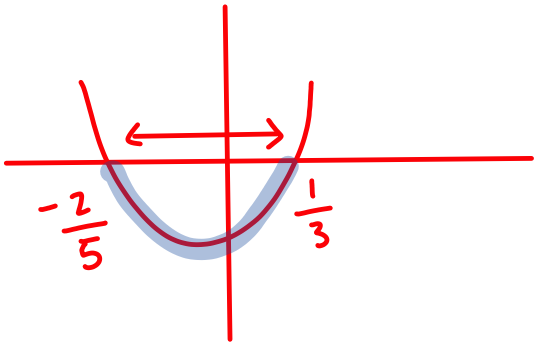
$y = \sqrt{3}x + c$
$6 = \sqrt{3}(4) + c$
$6 = 4\sqrt{3} + c$
$6 - 4\sqrt{3} = c$

L: $y = \sqrt{3}x + (6 - 4\sqrt{3})$
$f = \sqrt{3}(-2) + (6 - 4\sqrt{3})$
$f = -4.3923$

(Total for Question 20 is 5 marks)

21 Solve $(3x - 1)(5x + 2) < 0$

$x = \frac{1}{3}$ OR $x = -\frac{2}{5}$



$-\frac{2}{5} < x < \frac{1}{3}$

(Total for Question 21 is 2 marks)

22 The equation of circle **A** is $x^2 + y^2 = 25$

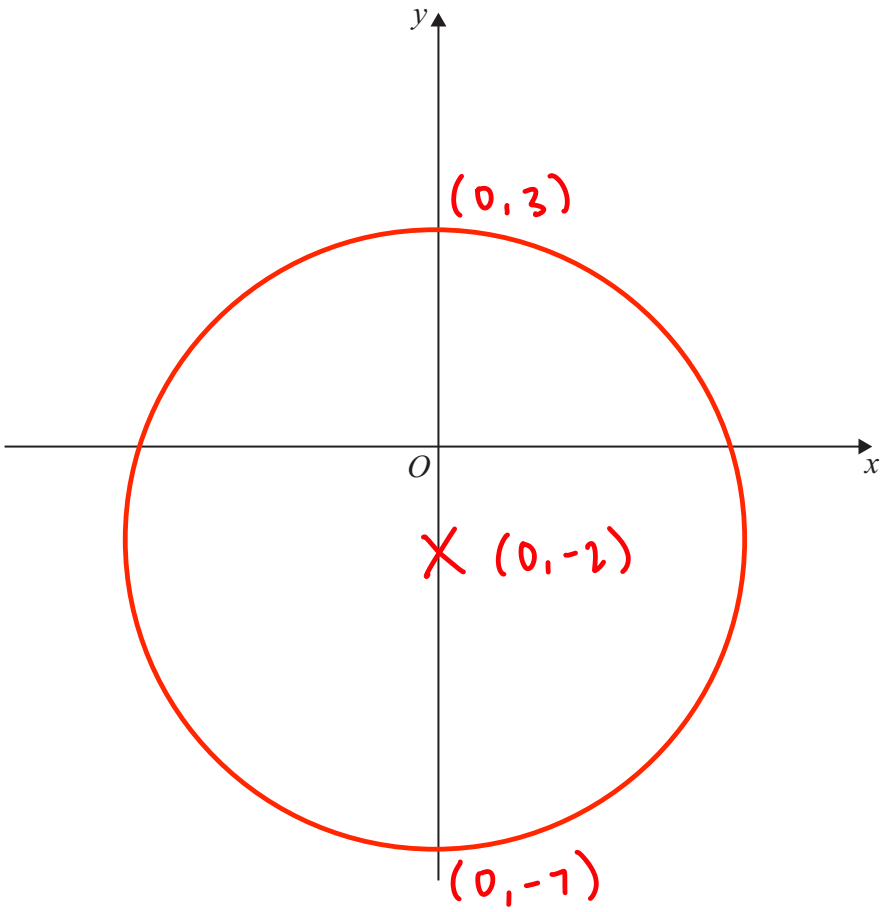
R = 5 Centre = (0, 0)

Circle **A** is translated by the vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$ to give circle **B**.

↳ -2 from y coordinates (move everything down by 2)

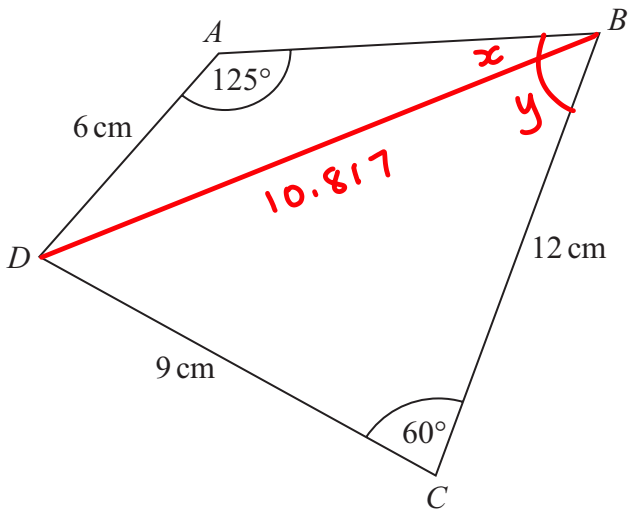
Sketch circle **B**.
Show the coordinates of
the centre of circle **B**
and the points where circle **B** meets the y-axis.

Centre = (0, -2)



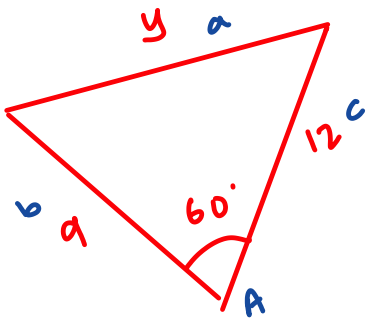
(Total for Question 22 is 3 marks)

23 *ABCD* is a quadrilateral.



Find the size of angle *ABC*.
Give your answer correct to the nearest degree.

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



$a^2 = 9^2 + 12^2 - 2(9)(12)\cos(60)$

$a^2 = 117$

$a = 10.817$

$\frac{\sin x}{6} = \frac{\sin(125)}{10.817}$

$x = \sin^{-1}\left(\frac{\sin(125)}{10.817} \times 6\right)$

$= 27.02°$

$\frac{\sin y}{9} = \frac{\sin(60)}{10.817}$

$y = \sin^{-1}\left(\frac{\sin(60)}{10.817} \times 9\right)$

$= 46.1°$

73 °

$27.02 + 46.1 = 73.1$

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS