

Pre Public Examination

GCSE Mathematics (Edexcel style)

May 2018

Higher Tier

Paper 2H *WORKED SOLUTIONS*

Name

Class

TIME ALLOWED

1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- **You are permitted to use a calculator in this paper.**
- Do all rough work in this book.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets () at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **80**.

Question	Mark	Out of
1		8
2		4
3		5
4		3
5		3
6		4
7		3
8		3
9		4
10		3
11		3
12		3
13		4
14		5
15		2
16		4
17		4
18		3
19		5
20		4
21		3
Total		80

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

Question 1.

The table below shows the percentages obtained by 10 students on Paper 1 and Paper 2 of an examination.

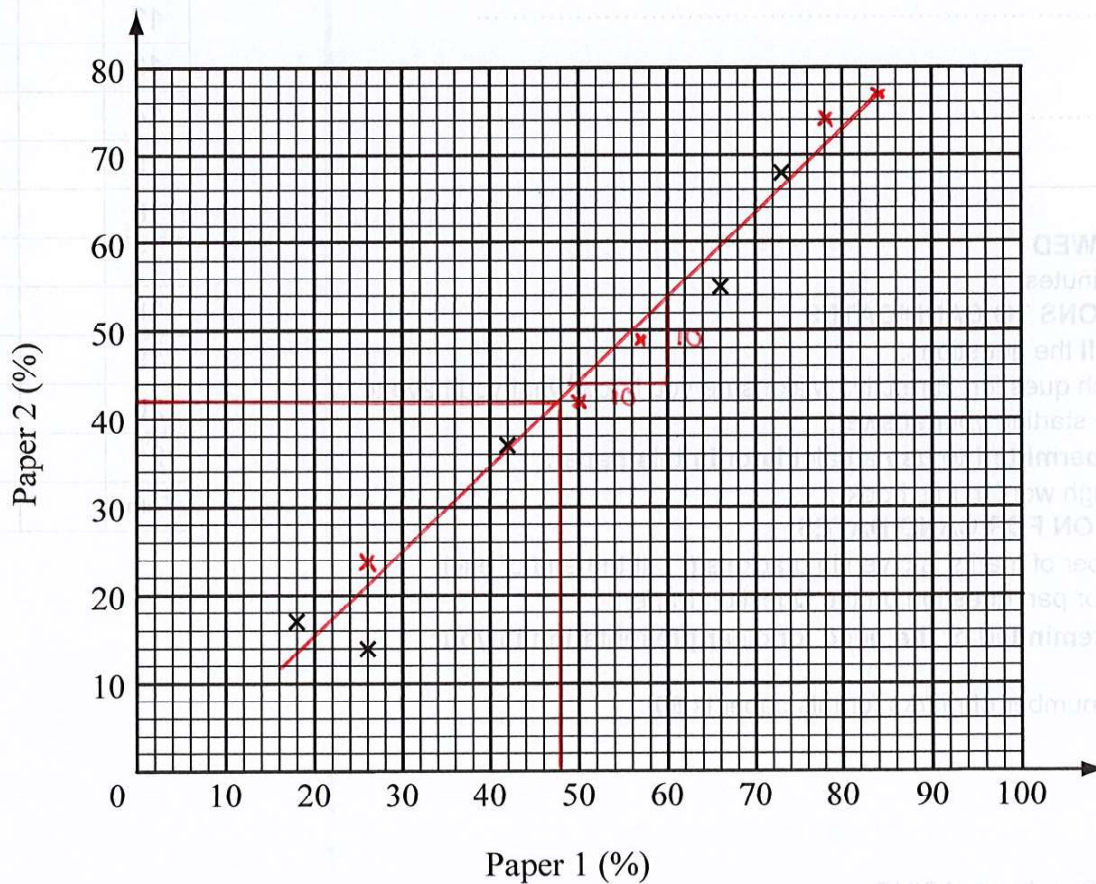
Student	A	B	C	D	E	F	G	H	I	J
Paper 1	73	26	66	42	18	50	78	84	26	57
Paper 2	68	14	55	37	17	42	74	77	24	49

(a) Complete the scatter diagram on the grid below.

The first 5 students' percentages have been plotted.

BI for at least 2 points correctly plotted
BI for all points plotted correctly

(2)



(b) Tariq scored 48% on Paper 1, but was absent for Paper 2.

By drawing a line of best fit, estimate his percentage score on Paper 2.

BI for line of best fit drawn

42% BI %
(2)

(c) Why is your answer to part (b) only an estimate?

The line of best fit can vary CI

(1)

(d) Calculate the gradient of your line of best fit.

$$\frac{\text{change in } y}{\text{change in } x} = \frac{10}{10} = 1$$

1 AI

(2)

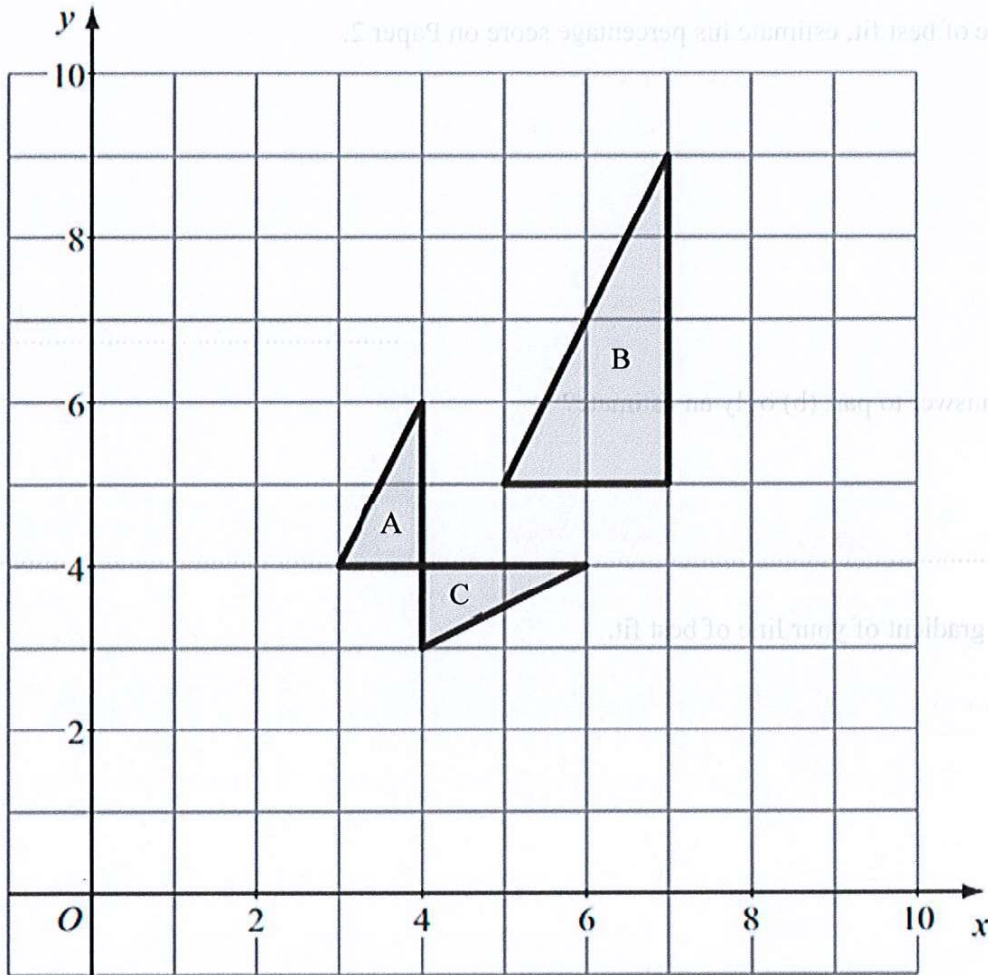
(e) Give an interpretation of the gradient of your line of best fit.

As the score in paper 1 increases, the score in paper 2 increases CI

(1)

(Total 8 marks)

Question 2.



(a) Describe fully the single transformation that maps triangle A onto triangle B.

ENLARGEMENT, SCALE FACTOR 2 B1 CENTRE (1, 3) B1

(2)

(b) Describe fully the single transformation that maps triangle A onto triangle C.

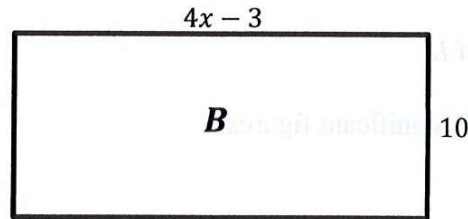
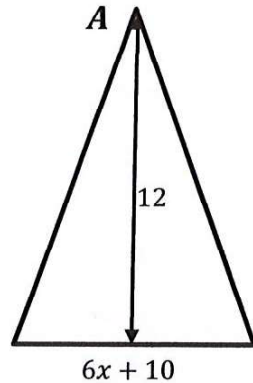
REFLECTION B1 MIRROR LINE $y = x$ B1

(2)

(Total 4 marks)

Question 3.

Here is a triangle and a rectangle.



All measurements are in centimetres.

The area of triangle A is the same as the area of rectangle B.

Work out the perimeter of rectangle B.

$$\frac{12(6x+10)}{2} = 10(4x-3) \quad \text{PI, PI}$$

$$\frac{72x + 120}{2} = 40x - 30$$

$$36x + 60 = 40x - 30$$

$$60 + 30 = 40x - 36x$$

$$90 = 4x$$

$$x = \frac{90}{4}$$

$$x = 22.5 \quad \text{PI}$$

Length of rectangle

$$(4 \times 22.5) - 3 = 87 \quad \text{PI}$$

$$87 + 87 + 10 + 10 = 194 \text{ cm}$$

.....194.....cm **A1**
(Total 5 marks)

Question 4.

$$H = \frac{y^2 - w^2}{2\pi^2}$$

$$y = 5, w = 11$$

Calculate the value of H .

Give your answer to 2 significant figures.

$$H = \frac{5^2 - 11^2}{2\pi^2} \quad M1$$

$$H = \frac{25 - 121}{2\pi^2}$$

$$H = \frac{-96}{2\pi^2} \quad M1$$

$$H = \frac{-48}{\pi^2}$$

$$H = -4.863416815$$

$$H = -4.9 \quad A1$$

(Total 3 marks)

Question 5.

The table shows the number of letters delivered to the 30 houses in a street.

Number of Letters Delivered	Number of Houses (Frequency)
$0 < L \leq 2$	10
$2 < L \leq 4$	8
$4 < L \leq 7$	5
$7 < L \leq 10$	3
$10 < L \leq 14$	4

MIDPOINT

1

3

5.5

8.5

12

Calculate an estimate for the mean number of letters delivered per house.

Give your answer to the nearest integer.

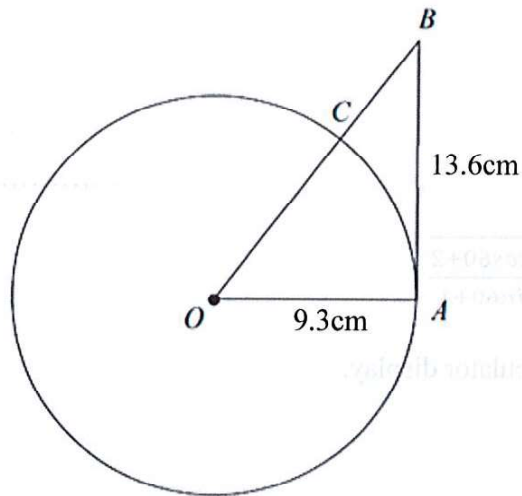
$$(1 \times 10) + (3 \times 8) + (5.5 \times 5) + (8.5 \times 3) + (12 \times 4) = 135 \quad M1$$

$$\frac{135}{30} = 4.5 \quad M1$$

5 A1

(Total 3 marks)

Question 6.



A is a point on a circle with centre O and radius 9.3cm .

AB is the tangent to the circle at A .

$AB = 13.6\text{cm}$.

OB intersects the circle at C .

Calculate the length of BC .

Give your answer to 3 significant figures.

$$13.6^2 + 9.3^2 = OB^2 \quad P1$$

$$184.96 + 86.49 = OB^2$$

$$271.45 = OB^2 \quad P1$$

$$OB = \sqrt{271.45}$$

$$OB = 16.47573974$$

$$16.47573974 - 9.3 = 7.175739741 \quad P1$$

7.18 cm AI

(Total 4 marks)

Question 7.

(a) What is the reciprocal of 8

$$\frac{1}{8} \quad \text{or} \quad 0.125 \quad \text{A1}$$

(1)

(b) Use your calculator to work out $\sqrt[3]{\frac{3\cos 60+2}{\sin 60+1}}$

Write down all the numbers on your calculator display.

$$= \sqrt[3]{\frac{3 \cdot 5}{1.866025404}} \quad \text{M1}$$

$$= \sqrt[3]{14.727272727272727}$$

$$1.233247274 \quad \text{A1}$$

(2)

(Total 3 marks)

Question 8.

Make r the subject of $s = \sqrt{2r + \frac{rw}{5}}$

$$s^2 = 2r + \frac{rw}{5} \quad \text{M1}$$

$$5s^2 = 10r + rw \quad \text{M1}$$

$$5s^2 = r(10+w)$$

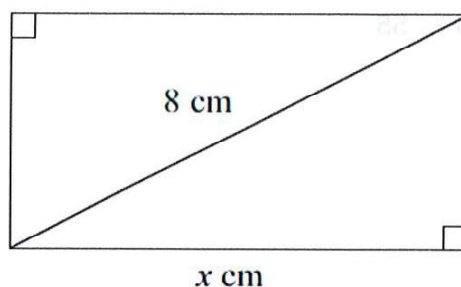
$$r = \frac{5s^2}{10+w}$$

$$r = \frac{5s^2}{10+w}$$

(Total 3 marks)

Question 9.

The diagram shows a rectangle.



The length of the rectangle is x cm.

The length of a diagonal of the rectangle is 8 cm.

The perimeter of the rectangle is 20 cm.

(a) Show that $x^2 - 10x + 18 = 0$

$$\frac{20 - 2x}{2} = \text{short length of rectangle}$$

$$10 - x = \sqrt{8^2 - x^2}$$

$$(10 - x)^2 = 8^2 - x^2 \quad \text{M1}$$

$$100 - 20x + x^2 = 64 - x^2 \quad \text{M1}$$

$$2x^2 - 20x + 36 = 0 \quad \text{M1}$$

$$x^2 - 10x + 18 = 0 \quad \text{C1}$$

(Total 4 marks)

Question 10.

Calculate the n^{th} term of the following quadratic sequence

$$\begin{array}{cccccc} -1 & 7 & 19 & 35 & 55 \\ & \underbrace{\quad} & \underbrace{\quad} & \underbrace{\quad} & \\ & 8 & 12 & 16 & 20 \\ & \underbrace{\quad} & \underbrace{\quad} & \underbrace{\quad} & \\ & 4 & 4 & 4 & \end{array}$$

$2n^2$ M1

$$\begin{array}{r} -1 \quad 7 \quad 19 \quad 35 \quad 55 \\ - \quad 2 \quad 8 \quad 18 \quad 32 \quad 50 \\ \hline -3 \quad -1 \quad 1 \quad 3 \quad 5 \\ \underbrace{\quad} \quad \underbrace{\quad} \quad \underbrace{\quad} \quad \underbrace{\quad} \\ 2 \quad 2 \quad 2 \quad 2 \end{array}$$

$2n - 5$

$2n^2 + 2n - 5$ A1

(Total 3marks)

Question 11.

Express the recurring decimal $0.2\dot{1}\dot{3}$ as a fraction.

$$\begin{array}{l} x = 0.\dot{2}\dot{1}\dot{3} \\ 10x = 2.\dot{1}\dot{3} \quad \text{--- ①} \\ 1000x = 213.\dot{1}\dot{3} \quad \text{--- ②} \end{array}$$

M1

② - ①

$990x = 211$ M1

$x = \frac{211}{990}$ A1

(Total 3 marks)

Question 13.

A plane is flying at a constant height of 8000m.

It flies vertically above me and 30 seconds later the angle of elevation is 74° .

Find the speed of the plane.

Give your answer to one decimal place.

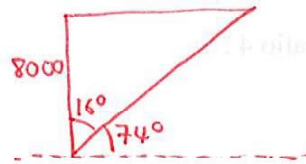
$$\tan 16 = \frac{\text{opposite}}{8000} \quad \text{PI}$$

$$8000 \tan 16 = \text{opposite}$$

$$\text{opposite} = 2293.963086 \quad \text{PI}$$

$$S = 2293.963086 \div 30$$

$$S = 76.4654362 \quad \text{AI}$$



$$90 - 74 = 16^\circ$$

PI

.....m/s
(Total 4 marks)

Question 14.

The life expectancy, L , of a rat varies inversely to the square of the density, d , of poison distributed around its home.

When the density of poison is 2g/m^2 the life expectancy is 12.5 days.

(a) How long will the rat survive if the density of poison is 5g/m^2 ?

$$L \propto \frac{k}{d^2}$$

$$L = \frac{50}{d^2}$$

$$12.5 = \frac{k}{2^2}$$

$$L = \frac{50}{5^2} \quad \text{M1}$$

$$k = 50 \quad \text{M1}$$

$$2 \text{ days} \quad \text{AI}$$

(3)

(b) What is the density of poison, if the life expectancy is 1.3 days?

Give your answer to 2 decimal places.

$$1.3 = \frac{50}{d^2}$$

$$d = \sqrt{\frac{500}{13}}$$

$$d^2 = \frac{50}{1.3}$$

$$d = 6.201736729$$

$$d^2 = \frac{500}{13}$$

$$d = 6.2$$

(2)

(Total 5 marks)

Question 12.

Thomas and Dan share their profits in the ratio 2 : 5

Thomas gets £F

Dan gets £G

Katy and Sam share twice as much profit as Thomas and Dan share.

They share the profit in the ratio 4 : 1

Katy gets £H

Sam gets £I

Find $F : G : H : I$

Give your answer in its simplest form.

$$\frac{4}{5} \times 2x = \frac{8x}{5} \quad \frac{1}{5} \times 2x = \frac{2x}{5} \quad \text{PI}$$

$$\frac{2x}{7} : \frac{5x}{7} : \frac{8x}{5} : \frac{2x}{5} \quad \text{PI}$$

$$\frac{10x}{35} : \frac{25x}{35} : \frac{56x}{35} : \frac{14x}{35}$$

$$10 : 25 : 56 : 14 \quad \text{AI}$$

(Total 3 marks)

Question 15.

A DIY shop sells 12 different types of screwdrivers.

Gary buys a different type of screwdriver on Monday, on Tuesday and on Wednesday.

In how many ways can he do this?

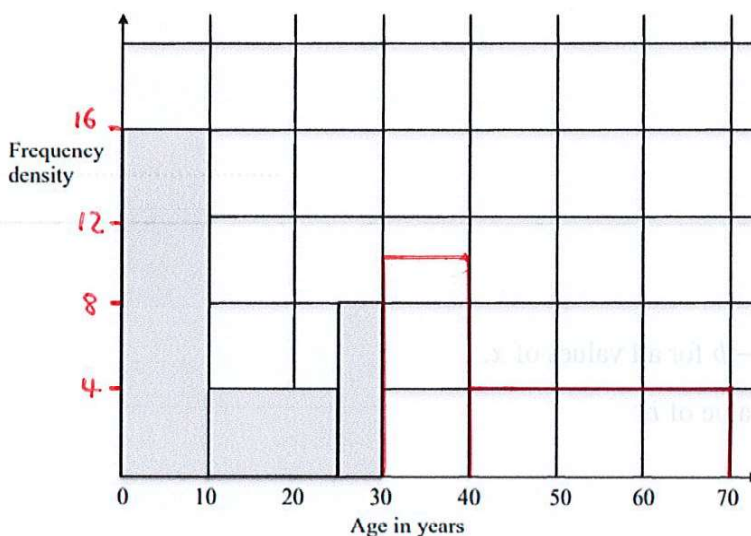
12 x 11 x 10 MI

1320 AI

(Total 2 marks)

Question 16.

The incomplete table and histogram give some information about the ages of the people who live in a town in Wales.



BI for one correct column
BI for all correct columns

(a) Use the information in the histogram to complete the frequency table below

Age (x) in years	Frequency
$0 < x \leq 10$	160
$10 < x \leq 25$	15 x 4 = 60
$25 < x \leq 30$	5 x 8 = 40
$30 < x \leq 40$	100
$40 < x \leq 70$	120

FREQUENCY DENSITY

$160 \div 10 = 16$ MI

4

8

$100 \div 10 = 10$

$120 \div 30 = 4$ (2)

BI for all correct entries

(b) Complete the histogram.

(2)

(Total 4 marks)

Question 17.

A container has a surface area of 5000cm^2 and a capacity of 12.8 litres.

Find the surface area of a similar container which has a capacity of 5.4 litres.

$$\frac{12.8}{5.4} = \frac{64}{27} \quad \text{M1}$$

$$\text{LSF} = \frac{4}{3} \quad \text{ASF} = \frac{16}{9} \quad \text{M1}$$

$$5000 \div \frac{16}{9} = 2812.5 \quad \text{M1}$$

$$2812.5\text{cm}^2 \quad \text{A1}$$

(Total 4 marks)

Question 18.

$$x^2 + 14x - 63 = (x + a)^2 - b \text{ for all values of } x.$$

Find the value of a and the value of b .

$$(x+7)^2 - 49 - 63 \quad \text{M1}$$

$$(x+7)^2 - 112 \quad \text{M1}$$

$$a = 7 \quad \text{A1}$$

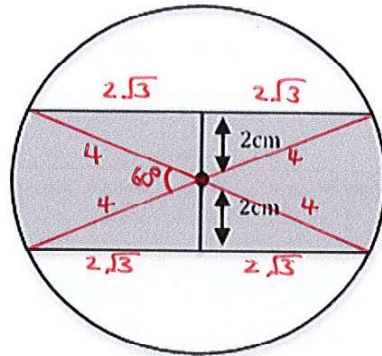
$$b = 112$$

(Total 3 marks)

Question 19.

Two parallel lines are drawn 2cm from the centre of a circle of radius 4cm.

Calculate the shaded area to one decimal place.

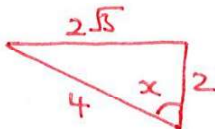


P1 for splitting shape into triangles and sectors

$$\begin{aligned} &= \sqrt{4^2 - 2^2} \\ &= \sqrt{16 - 4} \\ &= \sqrt{12} \\ &= 2\sqrt{3} \quad \text{P1} \end{aligned}$$

$$\begin{aligned} \text{Area of 1 triangle: } &\frac{2 \times 2\sqrt{3}}{2} \\ &= \frac{4\sqrt{3}}{2} \\ &= 2\sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{Area of 4 triangles: } &4 \times 2\sqrt{3} \\ &= 8\sqrt{3} \end{aligned}$$



$$\begin{aligned} \sin x &= \frac{2\sqrt{3}}{4} \\ x &= \sin^{-1} \frac{2\sqrt{3}}{4} \quad \text{P1} \\ x &= 60^\circ \end{aligned}$$

Angles on straight line add to 180° .

$$\begin{aligned} 60 + 60 &= 120 \\ 180 - 120 &= 60 \end{aligned}$$

$$\begin{aligned} \text{Area of sector: } &\frac{60}{360} \times \pi 4^2 \\ &= \frac{1}{6} \times \pi 16 \\ &= \frac{8\pi}{3} \quad \text{P1} \end{aligned}$$

$$\begin{aligned} \text{Area of both sectors: } &\frac{8\pi}{3} \times 2 \\ &= \frac{16\pi}{3} \end{aligned}$$

Area of shaded region:

$$8\sqrt{3} + \frac{16\pi}{3} = 30.61156$$

$$30.6 \text{ cm}^2 \quad \text{A1}$$

(Total 5 marks)

Question 20.

When a voltage V is applied to a resistance R , the power consumed P is given by $P = \frac{V^2}{R}$.

If you measure V as 12.2 and R as 2.6, both correct to 1 decimal place.

Calculate the smallest possible value of P to 1 decimal place.

$$\frac{0.1}{2} = 0.05$$

$$\begin{aligned} \underline{\underline{V}} \quad 12.2 + 0.05 &= 12.25 \quad \text{UB} \quad \text{M1} \\ 12.2 - 0.05 &= 12.15 \quad \text{LB} \end{aligned}$$

$$\begin{aligned} \underline{\underline{R}} \quad 2.6 + 0.05 &= 2.65 \quad \text{UB} \\ 2.6 - 0.05 &= 2.55 \quad \text{LB} \end{aligned}$$

$$P = \frac{12.15^2}{2.65} \quad \text{M1, M1}$$

$$P = 55.70660377$$

$$P = \underline{\underline{55.7}} \quad \text{A1}$$

(Total 4 marks)

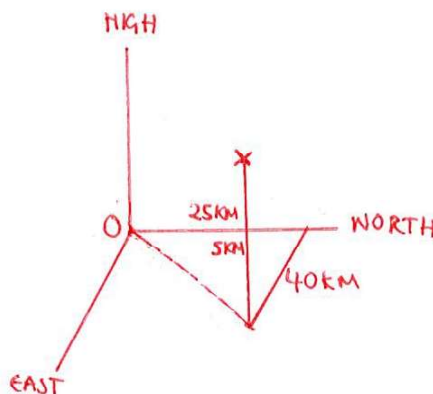
Question 21.

Measured from a control tower O, an aircraft is 25km north, 40km east and 5km high.

Find the distance from the control tower to the aircraft.

Give your answer to one decimal place.

$$\begin{aligned}
 & \sqrt{25^2 + 40^2 + 5^2} \quad \text{M1, M1} \\
 & = \sqrt{2250} \\
 & = 15\sqrt{10} \\
 & = 47.4341649 \\
 & = 47.4 \text{ km} \quad \text{A1}
 \end{aligned}$$



(Total 3 marks)

TOTAL FOR PAPER IS 80 MARKS