

2011 INT 2 SOLUTIONS

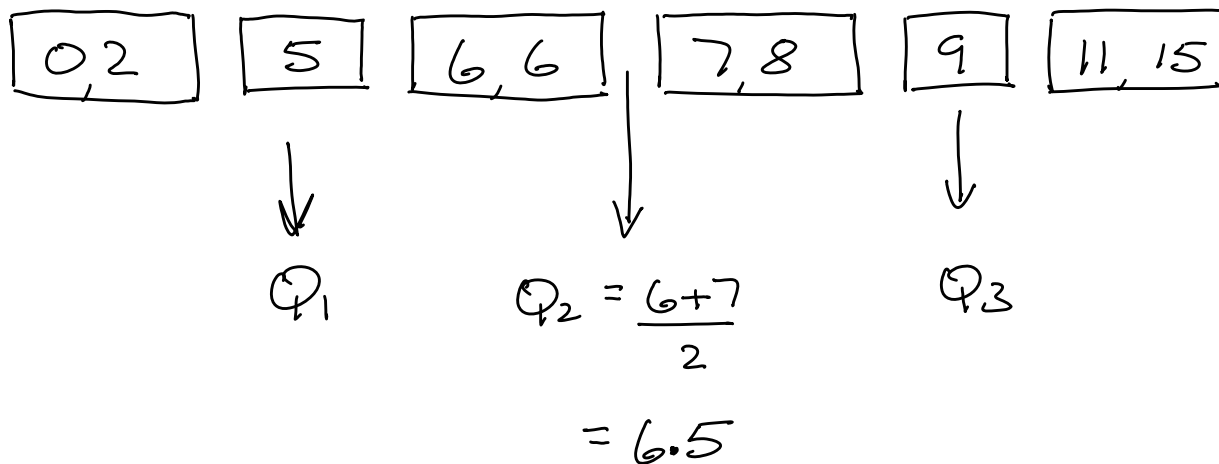
PAPER 1 UNITS 1, 2 and APPLICATIONS

1/ ~~5~~, ~~6~~, ~~15~~, ~~0~~, ~~6~~, ~~11~~, ~~2~~, ~~9~~, ~~8~~, ~~7~~

re-arrange 0, 2, 5, 6, 6, 7, 8, 9, 11, 15

amount of data = 10

$$10 \div 4 = 2R2$$

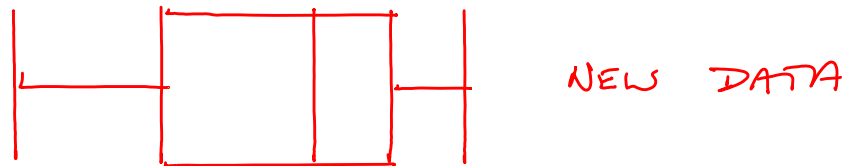
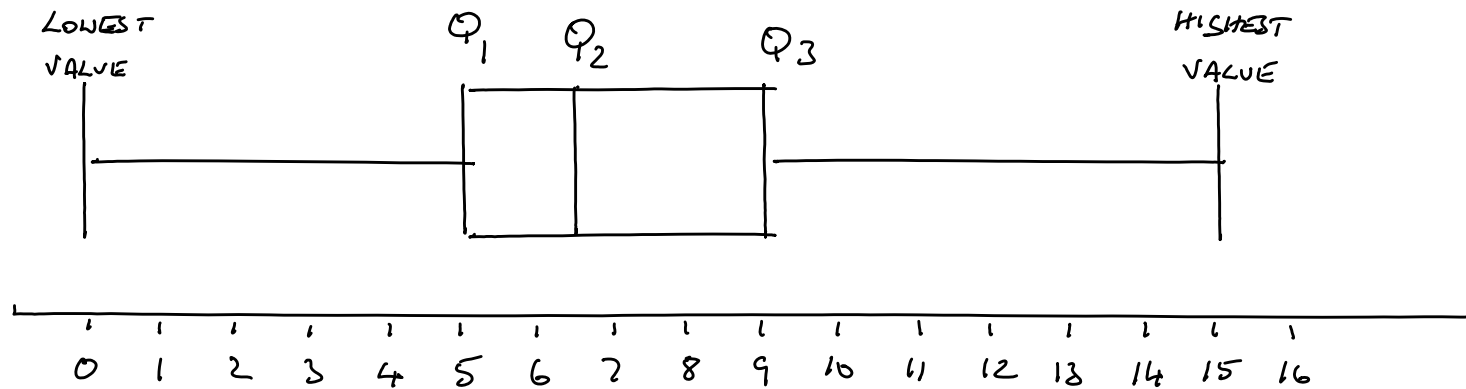


(i) MEDIAN = $Q_2 = 6.5$

(ii) LOWER QUARTILE = $Q_1 = 5$

(iii) UPPER QUARTILE = $Q_3 = 9$

(b)



As can be seen from above the overall N^o of mins late has improved also the consistency of latencies has improved

$$\text{SEMI INTERQUANTILE RANGE OF ORIGINAL} = \frac{9-5}{2} = \frac{4}{2} = 2$$

$$\text{NEW DATA} = \frac{5-2}{2} = \frac{3}{2} = 1.5$$

$$2/ \quad x^2 - 4x - 21 \quad \begin{array}{l} -1 \times 21 \\ +3 \times -7 \end{array}$$

$$(x+3)(x-7)$$

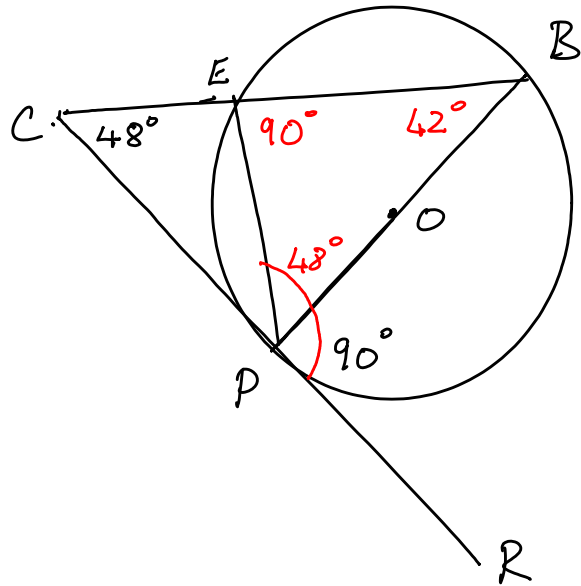
$$3/ \quad 5x + (3x+2)(2x+7)$$

$$5x + 3x(2x+7) + 2(2x+7)$$

$$\textcircled{5x} + 6x^2 + \textcircled{21x} + \textcircled{4x} + 14$$

$$6x^2 + 30x + 14$$

4/



FIND ANGLE EPR

$$\begin{aligned}\text{ANGLE } EBP &= 180 - (90 + 48) \\ &= 180 - 138 \\ &= \underline{\underline{42^\circ}}\end{aligned}$$

$$\text{ANGLE } BEP = 90^\circ$$

$$\text{THEREFORE ANGLE } EPB = 48^\circ$$

$$\text{ANGLE } BPR = 90^\circ$$

$$\begin{aligned}\text{SO ANGLE } EPR &= 48 + 90 \\ &= \underline{\underline{\underline{138^\circ}}}\end{aligned}$$

$$5/ \quad D = \frac{1}{3} \left(S + \frac{S^2}{20} \right)$$

find D when $S = 30 \text{ mph}$

$$= \frac{1}{3} \left(30 + \frac{30^2}{20} \right)$$

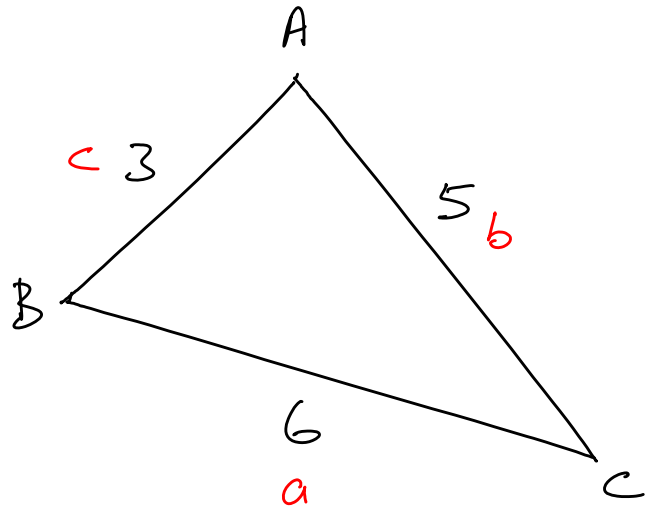
$$= \frac{1}{3} \left(30 + \frac{900}{20} \right)$$

$$= \frac{1}{3} (30 + 45)$$

$$= \frac{1}{3} (75)$$

$$= \underline{\underline{25 \text{ metres}}}$$

7/



Show that $\cos B = \frac{5}{9}$

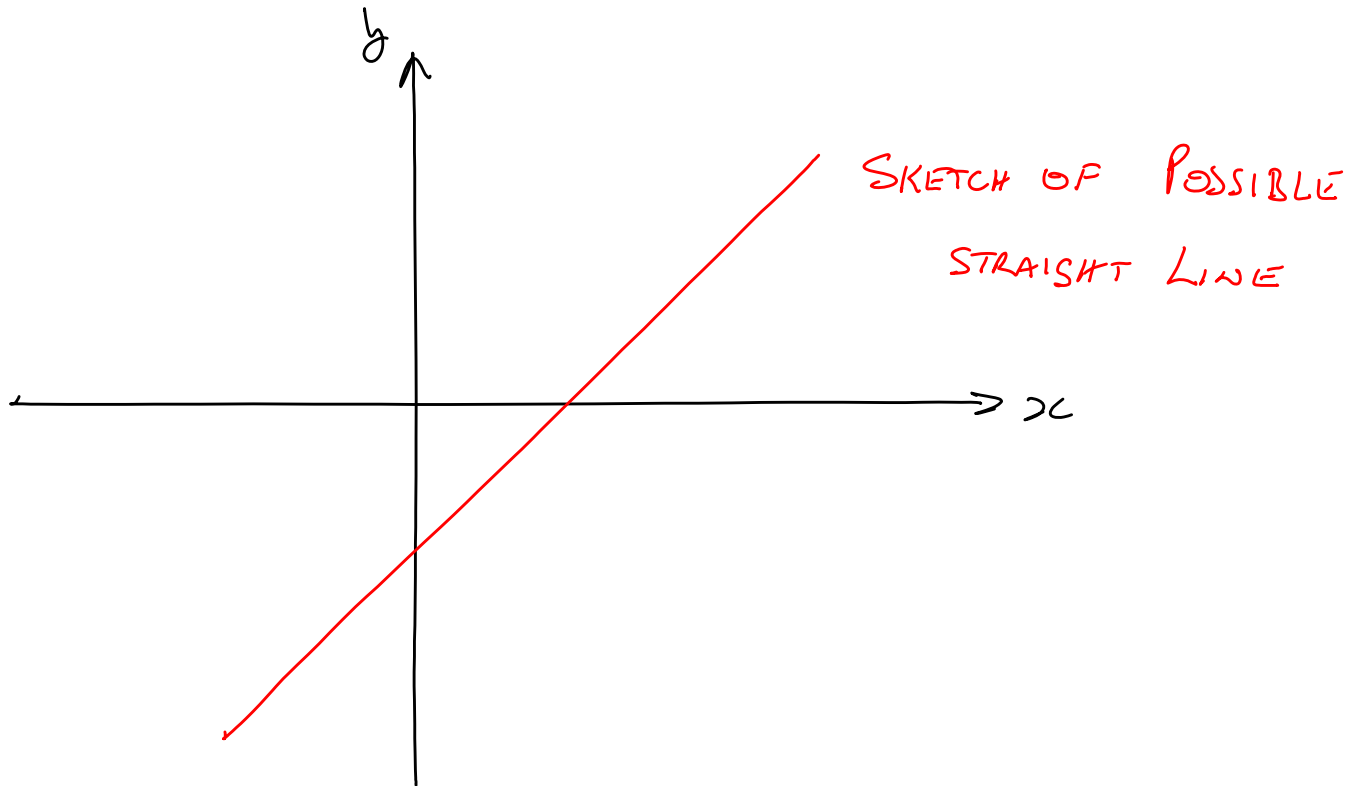
$$\begin{aligned}\cos B &= \frac{a^2 + c^2 - b^2}{2ac} \\ &= \frac{6^2 + 3^2 - 5^2}{2 \times 6 \times 3} \\ &= \frac{36 + 9 - 25}{36} \\ &= \frac{20 \div 4}{36 \div 4} \\ &= \frac{5}{9}\end{aligned}$$

8/ $y = mx + c$ where $m = \text{gradient}$

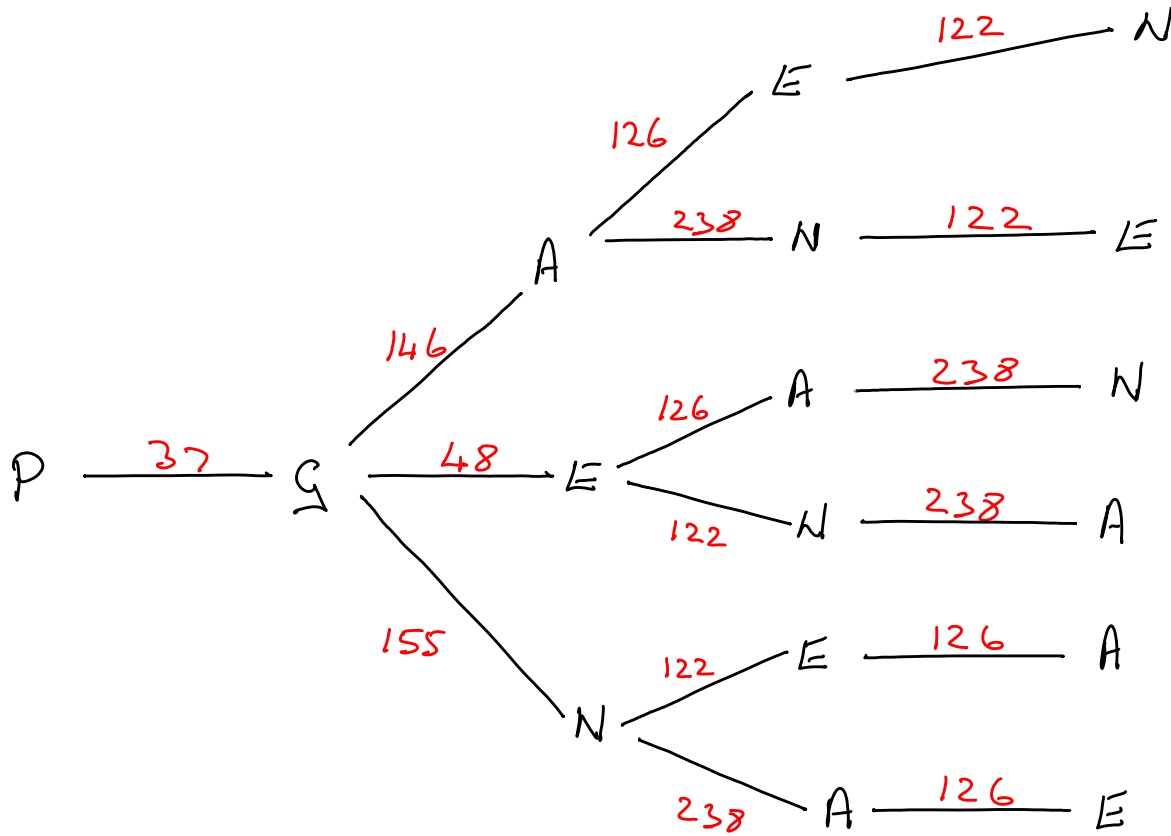
$c = \text{y-intercept}$

if $m > 0$ then gradient positive

$c < 0$ then y-intercept is negative



9/



6 possible routes

(b) finish at Newcastle — 2 possible routes.

$$\begin{array}{r} \text{(i)} \quad 37 \\ 146 \\ 126 \\ + 122 \\ \hline 431 \end{array}$$

431 miles

$$\begin{array}{r} \text{(ii)} \quad 37 \\ 48 \\ 126 \\ + 238 \\ \hline 449 \end{array}$$

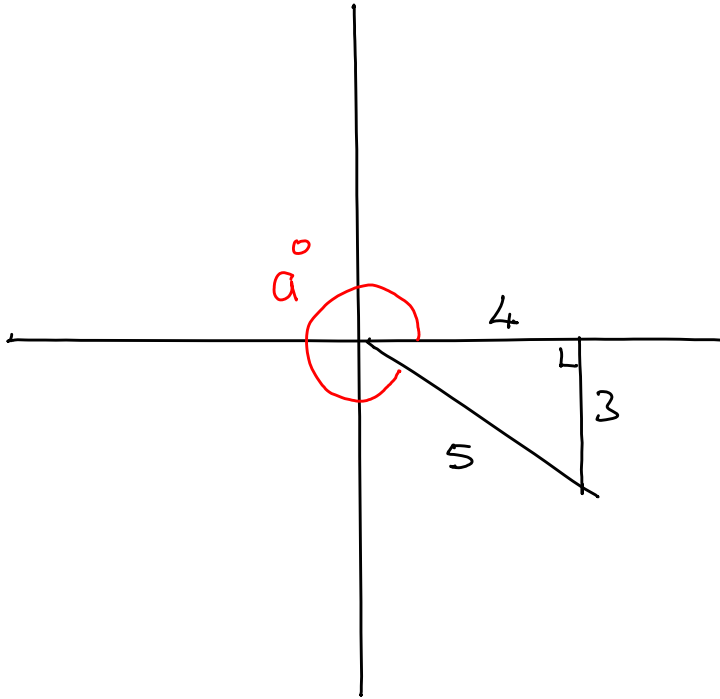
449 miles

Shortest route is:

PRESTWICK → GLASGOW → ABERDEEN → EDINBURGH → NEWCASTLE

431 miles

10



$$\cos \alpha^\circ = \frac{x}{r} = \frac{4}{5}$$

≡

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PAPER 2 UNITS 1, 2 AND APPLICATIONS

$$\begin{aligned} \frac{1}{\text{gradient}} &= \frac{y_2 - y_1}{x_2 - x_1} && \begin{matrix} x_1, y_1 \\ (-3, 5) \end{matrix} && \begin{matrix} x_2, y_2 \\ (7, -4) \end{matrix} \\ &= \frac{(-4) - 5}{7 - (-3)} \\ &= \frac{-9}{10} \\ &= -\frac{9}{10} \end{aligned}$$

2/ increase at 3.15% per annum

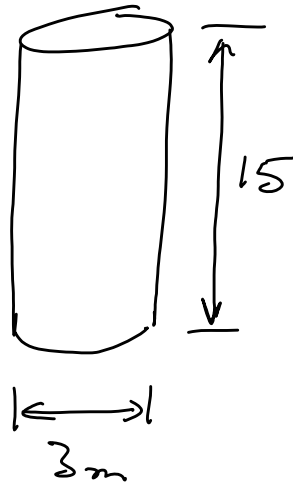
House Value after 3 years

$$= \text{£} 134,750 \times 1.0315^3$$

$$= \text{£} 147,889.20$$

$$= \text{£} 147,900 \text{ to 4sf.}$$

3/ (a)



$$\text{diam} = 3\text{m}$$

$$\text{rad} = 1.5\text{m}$$

$$\text{VOLUME OF CYLINDER} = \pi r^2 h$$

$$= \pi \times 1.5^2 \times 15$$

$$= \underline{\underline{106.03 \text{ m}^3}}$$

$$(b) \text{ VOLUME OF CONE} = \frac{1}{3} \pi r^2 h = 5.7$$

$$\text{where } r = 1.5$$

$$h = \frac{5.7 \times 3}{\pi r^2}$$

$h =$ height of
cone

$$\text{height of cone} = \frac{5.7 \times 3}{\pi \times 1.5^2}$$

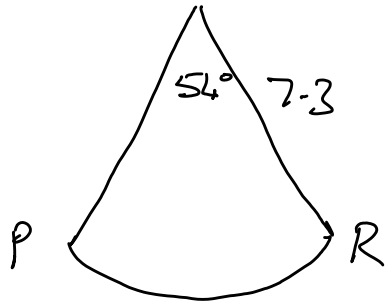
$$= 2.42 \text{ metres}$$

$$\text{Total height of Pencil} = 15 + 2.42$$

$$= 17.42 \text{ metres}$$

17.42 metres

4/



$$r = 7.3 \text{ cm}$$

$$d = 14.6 \text{ cm}$$

$$\begin{aligned} \text{Area of circle} &= \pi r^2 \\ &= \pi \times 7.3^2 \end{aligned}$$

$$\text{fraction of area} = \frac{54}{360}$$

$$\text{Area of sector} = \frac{54}{360} \times \pi \times 7.3^2$$

$$= \underline{\underline{\underline{25.11 \text{ cm}^2}}}$$

5/

N ^o	DEVIATION	DEVIATION ²
43	43 - 41 = 2	4
39	39 - 41 = -2	4
41	41 - 41 = 0	0
40	40 - 41 = -1	1
39	39 - 41 = -2	4
44	44 - 41 = 3	9
TOTAL 246	TOTAL	22

$$\text{MEAN} = \frac{246}{6}$$

$$= 41$$

$$sd = \sqrt{\frac{22}{n-1}} = \sqrt{\frac{22}{5}} = \sqrt{4.4}$$

$$sd = \sqrt{4.4} = 2.097$$

$$= 2.1 \text{ to } 1 \text{ dp}$$

(b) data produced mean = 41 sd = 2.1

company claim mean 40 ± 2 sd < 3

Yes the data supports the claim as can be seen by above figures.

$$6/ \quad (a) \quad 24x + 6y = 60 \quad \text{---} \quad (1)$$

$$(b) \quad 20x + 10y = 40 \quad \text{---} \quad (2)$$

$$(c) \quad \text{Multiply } (1) \times 5 \qquad 120x + 30y = 300 \quad \text{---} \quad (3)$$

$$\text{Multiply } (2) \times 3 \qquad \underline{60x + 30y = 120} \quad \text{---} \quad (4)$$

$$\text{Subtract } 60x \qquad = 180$$

$$\text{therefore } x = \frac{180}{60} = 3$$

Sub $x = 3$ into (1).

$$24(3) + 6y = 60$$

$$72 + 6y = 60$$

$$6y = 60 - 72$$

$$6y = -12$$

$$\underline{\underline{y = -2}}$$

check

sub $x=3$ $y=-2$ into (2)

$$20(3) + 10(-2) = 40$$

$$60 - 20 = 40$$

$$40 = 40 \checkmark$$

$$\begin{aligned}\text{THEREFORE DAVID} &= 17x + 13y \\ &= 17(3) + 13(-2) \\ &= 51 - 26 \\ &= \underline{\underline{25 \text{ points}}}\end{aligned}$$

7/ PAID BACK IN TOTAL £12,339

PAID BACK MONTHLY OVER 5 years

$$\begin{aligned} \text{so no of payments} &= 5 \times 12 \\ &= \underline{60} \end{aligned}$$

$$\text{SAVWELL} \quad 245.39 \times 60 = \text{£} 14,723.40$$

$$214.39 \times 60 = \text{£} 12,863.40$$

$$\text{FINESAVE} \quad 260.58 \times 60 = \text{£} 15,634.80$$

$$205.65 \times 60 = \underline{\underline{\text{£} 12,339}}$$

$$\text{WISESPEND} \quad 263.17 \times 60 = \text{£} 15,790.20$$

$$214.70 \times 60 = \text{£} 12,882$$

BORROWED FROM FINESAVE WITHOUT PAYMENT PROTECTION.

8/ (a) from graph 4 runners completed in 50 mins or less.

$$(b) \frac{60}{4} = 15$$

split cumulative frequency into bands of 15

then from graph

$$Q_1 = 58 \text{ mins}$$

$$Q_3 = 70 \text{ mins}$$

$$\text{SIQR} = \frac{70 - 58}{2} = \frac{12}{2} = \underline{\underline{6}}$$

9) overtime is 1.5 of basic wage

$$\text{basic } 35 + (4 \times 1.5) = \text{£}255.84$$

$$35 + 6 = \text{£}255.84$$

$$41 \text{ hrs} = 255.84$$

$$\text{so hourly pay} = \frac{255.84}{41} = \text{£}6.24$$

$$\text{so overtime pay} = 6.24 \times 1.5$$

$$= \underline{\underline{\underline{\text{£}9.36}}}}$$

check $(35 \times 6.24) + (4 \times 9.36) = 255.84$

$$218.40 + 37.44 = 255.84$$

$$255.84 = 255.84$$

$$10/ (a) = (B4/12)$$

$$(b) = \text{SUM}(E7 + D8)$$

$$(c) E6 = 33,150 + 17,550 = \text{£}50,700$$

$$E7 = 16,800 + 1400 + 50,700 = \text{£}68,900$$

$$E8 = 17,400 + 1450 + 68,900 = \text{£}87,750$$

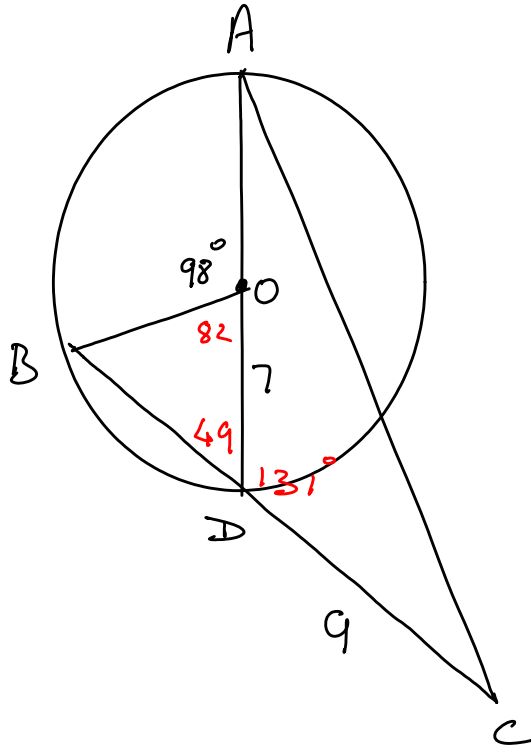
$$(d) \text{ After 3 years PAYWELL} = \underline{\text{£}50,700}$$

$$\text{HIGHPAY} = 28,600 + 17,600$$

$$= \underline{\text{£}46,200}$$

PAYWELL IS THE BETTER COMPANY AFTER 3 YEARS

11)



$$\text{radius} = 7 \text{ cm}$$

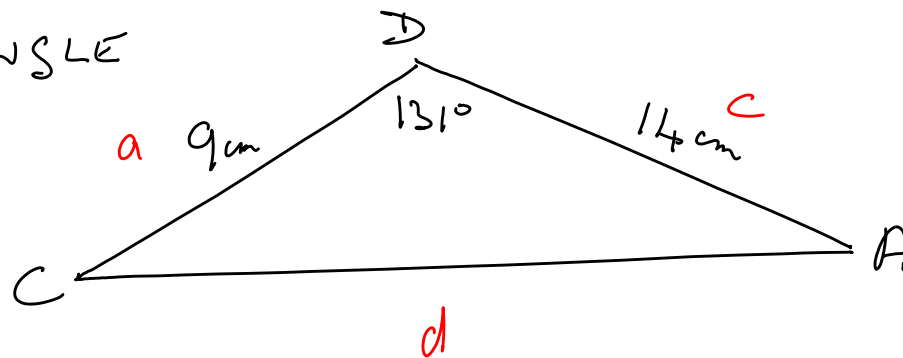
$$DC = 9 \text{ cm}$$

$$\text{Angle } BOD = 82^\circ$$

$$\text{therefore Angle } ODB = 49^\circ$$

$$\text{therefore Angle } ODC = 131^\circ$$

Now WE HAVE TRIANGLE



using Cosine Rule

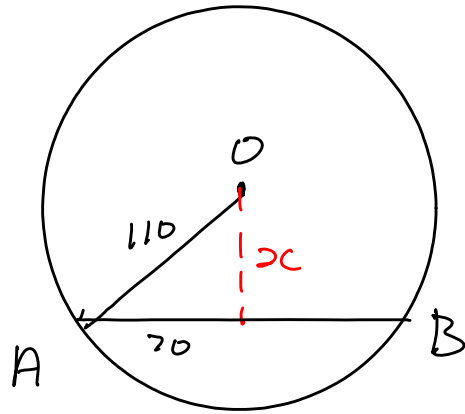
$$\begin{aligned}d^2 &= a^2 + c^2 - 2ac \cos D \\&= 9^2 + 14^2 - (2 \times 9 \times 14 \times \cos 131^\circ) \\&= 81 + 196 - (-165.33) \\&= 442.33\end{aligned}$$

$$d = \sqrt{442.33}$$

$$\underline{\underline{d = 21.03 \text{ cm}}}$$

Therefore length of AC = 21.03 cm

12/



$$AB = 140 \text{ mm}$$

$$\text{BLADE RADIUS} = 110 \text{ m}$$

using PYTHAGORAS

$$110^2 = x^2 + 70^2$$

$$x^2 = 110^2 - 70^2$$

$$x^2 = 7200$$

$$x = \sqrt{7200}$$

$$x = 84.85 \text{ mm}$$

84.85 mm

$$\text{depth of saw exposed} = 110 - 84.85$$

$$= \underline{\underline{25.15 \text{ mm}}}$$