2011 INT 2 SOLUTIONS

PAPER 1 UNITS 1, 2 and 3

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 $\qquad 10 \div 4 = 2 R 2$

$\boxed{0, 2}\ \boxed{5}\ \boxed{6, 6}\ \boxed{7, 8}\ \boxed{9}\ \boxed{11, 15}$

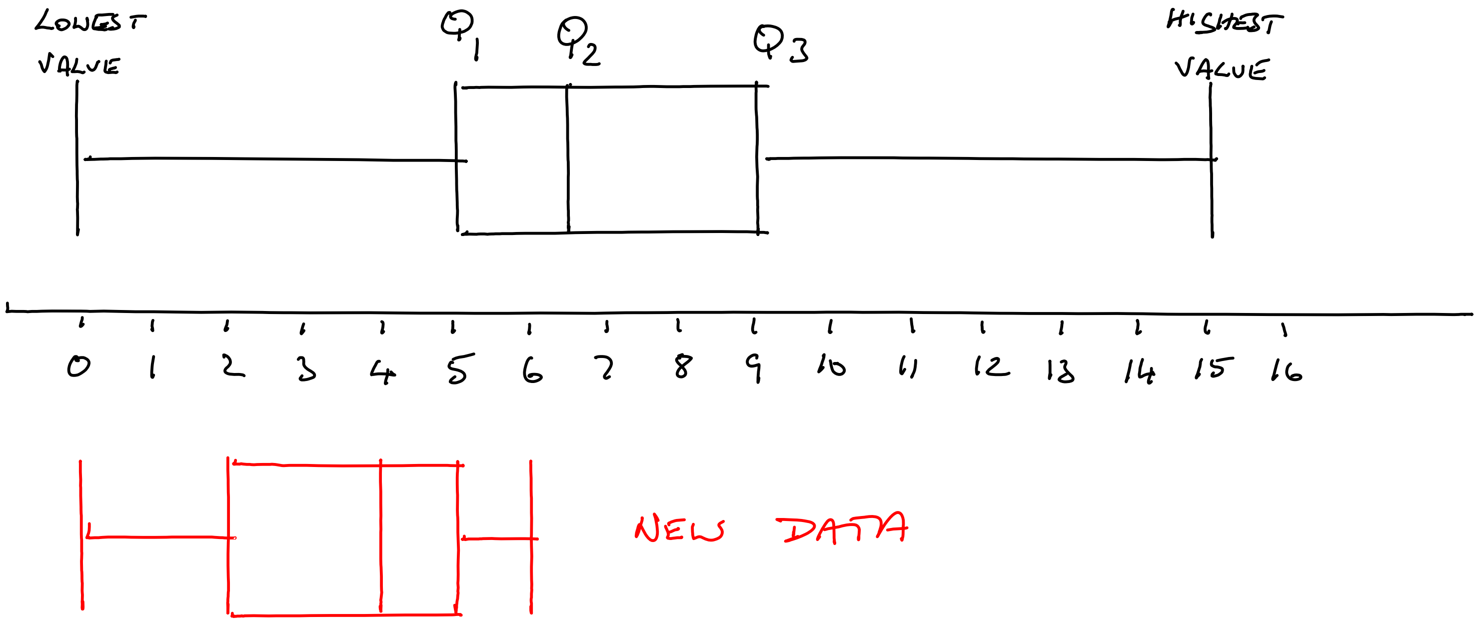
$Q_1 = 5$ $\qquad Q_2 = \frac{6+7}{2} = 6.5$ $\qquad Q_3 = 9$

(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° OF MINS LATE HAS IMPROVED ALSO THE CONSISTENCY OF LATENESS HAS IMPROVED

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

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

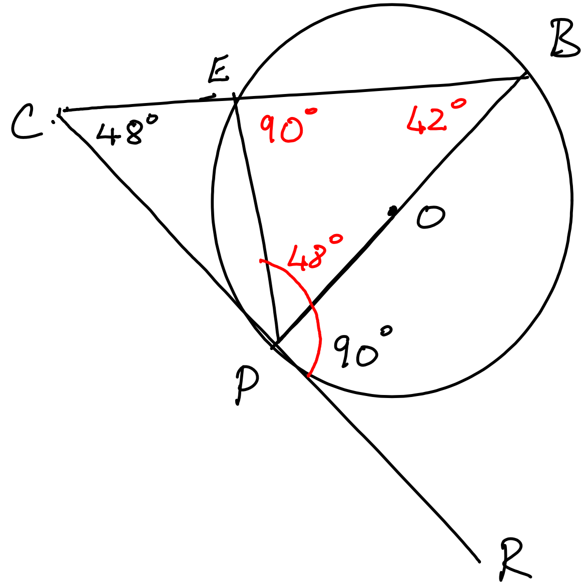
2/ $5x + (3x+2)(2x-7)$

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

$5x + 6x^2 - 21x + 4x - 14$

$6x^2 - 12x - 14$

3/



FIND ANGLE EPR

ANGLE EBP $= 180 - (90 + 48)$

$= 180 - 138$

$= \underline{\underline{42^\circ}}$

ANGLE BEP $= 90^\circ$

THEREFORE ANGLE EPB $= 48^\circ$

ANGLE BPR $= 90^\circ$

SO ANGLE EPR $= 48 + 90$

$= \underline{\underline{138^\circ}}$

4) $2\sqrt{6} = \sqrt{4\times 6} = \sqrt{24}$

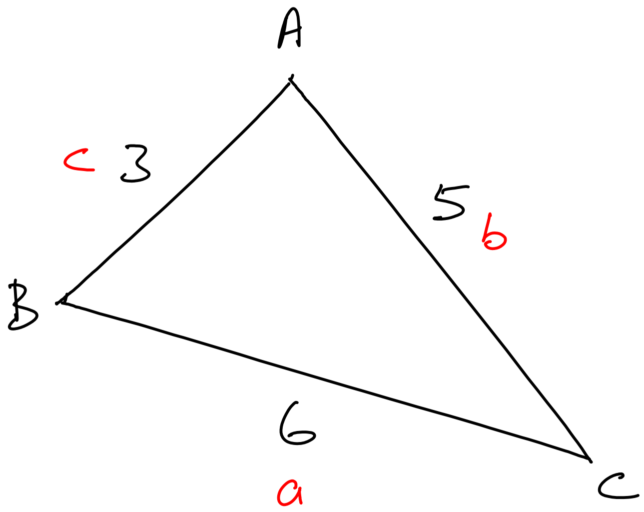
$\sqrt{2}\times\sqrt{12} = \sqrt{2\times 12} = \sqrt{24}$

$3\sqrt{8} = \sqrt{9\times 8} = \sqrt{72}$

$\sqrt{24}$

$3\sqrt{8}$ is the odd one out as it does not equate to $\sqrt{24}$

5)



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

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$= \frac{6^2 + 3^2 - 5^2}{2 \times 6 \times 3}$$

$$= \frac{36 + 9 - 25}{36}$$

$$= \frac{20}{36} \begin{matrix} \div 4 \\ \div 4 \end{matrix}$$

$$= \frac{5}{9}$$

6/ $9^{\frac{3}{2}} = \left(\sqrt{9}\right)^3$

$= 3^3$

$= \underline{\underline{27}}$

7/ $y = a\cos bx$

where a = amplitude

b = N° of cycles

so from graph $a = 5$

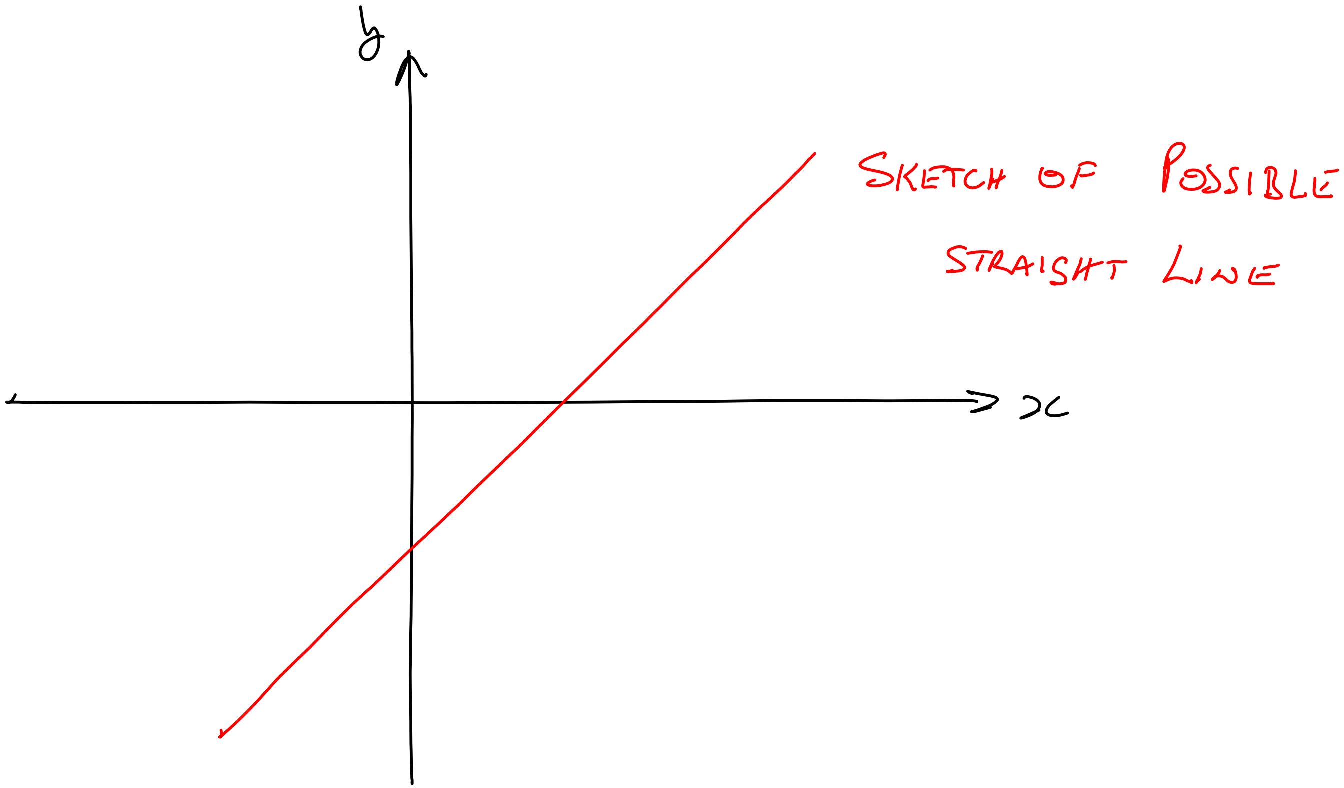
$b = 4$

8/ $y = mx + c$ where m = gradient

c = y-intercept

if $m > 0$ then gradient positive

$c < 0$ then y-intercept is negative



9/ (a) $x^2 - 4x - 21$ $\qquad \cancel{+21}$

$+3 \quad -7$

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

(b) $(x+3)(x-7) = 0$

either $(x+3) = 0$ then $x = -3$

or $(x-7) = 0$ then $x = 7$

roots of equation are $(-3, 0)$ and $(7, 0)$

(c) Coordinates of turning point

line of symmetry is halfway between $x = -3$ and $x = 7$

so $x = 2$

Substitute $x = 2$ into

$$y = x^2 - 4x - 21$$

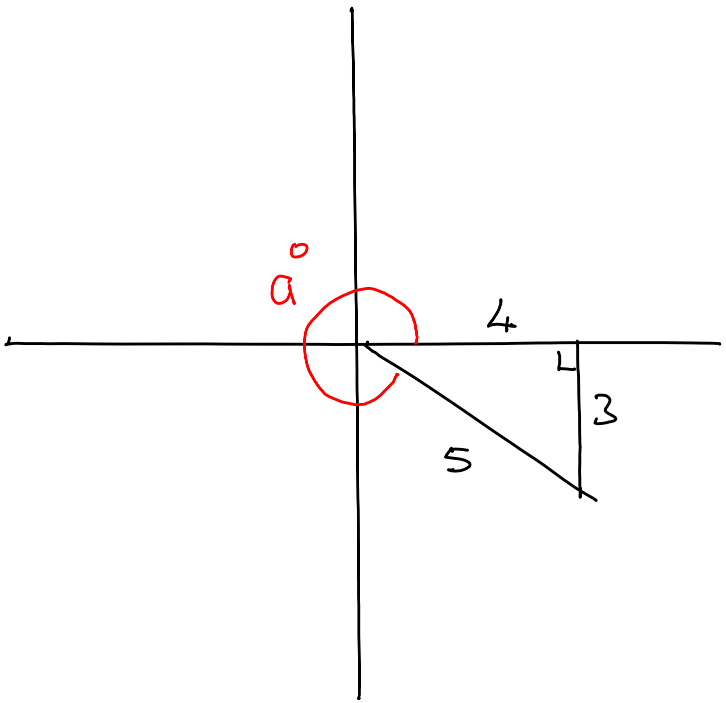
$$= (2)^2 - 4(2) - 21$$

$$= 4 - 8 - 21$$

$$y = -25$$

Coordinates of turning point $= (2, -25)$

10/



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

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1/

$$\text{gradient} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$\begin{array}{cc} x_1 & y_1 \\ (-3, & 5) \end{array} \quad \begin{array}{cc} x_2 & y_2 \\ (7, & -4) \end{array}$$

$$= \frac{(-4) - 5}{7 - (-3)}$$

$$= \frac{-9}{10}$$

$$= -\frac{9}{10}$$

2/ increase at 3.15% per annum

House Value after 3 years

$$= £134{,}750 \times 1.0315^3$$

$$= £147889.20$$

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

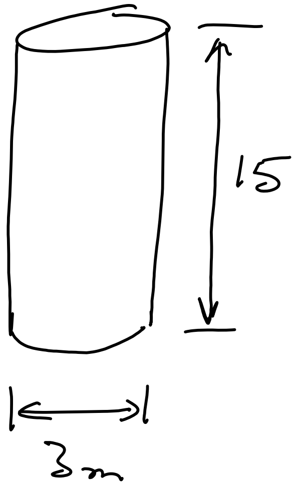
3/

$$A = 4\pi r^2$$

$$r^2 = \frac{A}{4\pi}$$

$$r = \sqrt{\frac{A}{4\pi}}$$

4/ (a)



dia = 3m

rad = 1.5m

VOLUME OF CYLINDER $= \pi r^2 h$

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

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

(b) VOLUME OF CONE $= \frac{1}{3}\pi r^2 h = 5.7$ where $r = 1.5$

h = height of cone

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

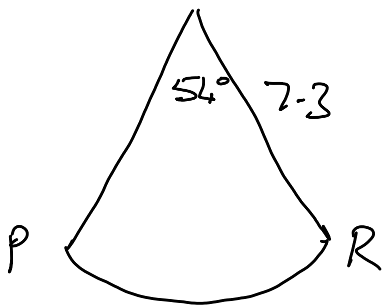
height of cone $= \dfrac{5 \cdot 7 \times 3}{\pi \times 1 \cdot 5^2}$

$= 2 \cdot 42$ metres

Total height of Pencil $= 15 + 2 \cdot 42$

$= 17 \cdot 42$ metres

5/



$r = 7{\cdot}3$ cm

$d = 14{\cdot}6$ cm

Area of circle $= \pi r^2$

$= \pi \times 7{\cdot}3^2$

fraction of area $= \dfrac{54}{360}$

Area of sector $= \dfrac{54}{360} \times \pi \times 7{\cdot}3^2$

$= \underline{\underline{25{\cdot}11 \text{ cm}^2}}$

6/

N°	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

$$\text{MEAN} = \frac{246}{6} = \underline{\underline{41}}$$

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

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

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

(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.

7/

(a) $24x + 6y = 60$ — ①

(b) $20x + 10y = 40$ — ②

(c) Multiply ① × 5 $\qquad 120x + 30y = 300$ — ③

Multiply ② × 3 $\qquad 60x + 30y = 120$ — ④

Subtract $\qquad 60x = 180$

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

sub $x = 3$ into ①

$24(3) + 6y = 60$

$72 + 6y = 60$

$$6y = 60 - 72$$

$$6y = -12$$

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

<u>check</u> sub $x = 3$ $y = -2$ into (2)

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

$$60 - 20 = 40$$

$$40 = 40 \checkmark$$

8/ $$\frac{3x-15}{(x-5)^2} = \frac{3\cancel{(x-5)}}{\cancel{(x-5)}(x-5)} = \frac{3}{(x-5)}$$

9/ $$\frac{3}{x} - \frac{4}{x+1}$$

$$\frac{3(x+1)-4x}{x(x+1)}$$

$$= \frac{3x+3-4x}{x(x+1)}$$

$$= \frac{3-x}{x(x+1)}$$

10/ $2\tan x^\circ - 3 = 5$

$2\tan x = 8$

$\tan x = \frac{8}{2} = 4$

$x = \tan^{-1}(4)$

$x = 75.96^\circ$

11) $4x^2 - 7x + 1 = 0$

$a = 4$
$b = -7$
$c = 1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-7) \pm \sqrt{(-7)^2 - 4(4)(1)}}{2(4)}$$

$$= \frac{7 \pm \sqrt{49 - 16}}{8}$$

$$= \frac{7 \pm \sqrt{33}}{8}$$

$$= \frac{7 + 5 \cdot 74}{8} \quad \text{or} \quad \frac{7 - 5 \cdot 74}{8}$$

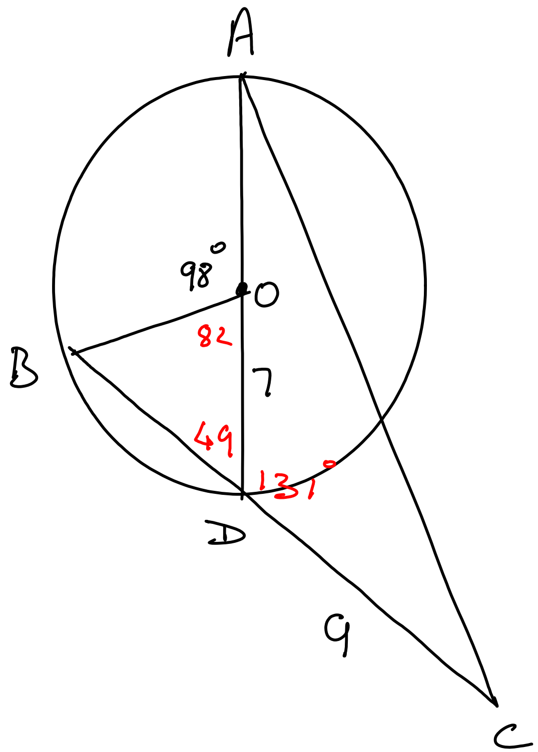
$$= \frac{12.74}{8} \quad \text{or} \quad \frac{1.26}{8}$$

$$= 1.59 \quad \text{or} \quad 0.157$$

$$= 1.6 \quad \text{or} \quad 0.2 \quad \text{to 1dp.}$$

Roots are $(1.6, 0)$ and $(0.2, 0)$

12/



radius = 7 cm

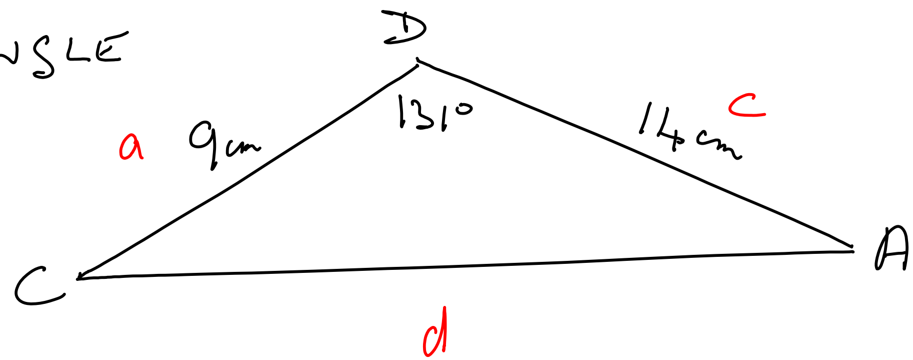
DC = 9 cm

Angle BOD = 82°

therefore Angle ODB = 49°

therefore Angle ODC = 131°

NOW WE HAVE TRIANGLE



using Cosine Rule

$$d^2 = a^2 + c^2 - 2ac\cos D$$

$$= 9^2 + 14^2 - (2 \times 9 \times 14 \times \cos 131^\circ)$$

$$= 81 + 196 - (-165.33)$$

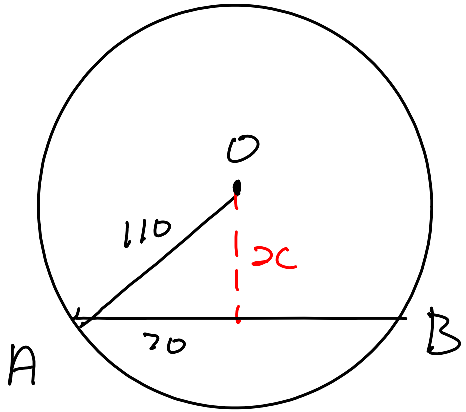
$$= 442.33$$

$$d = \sqrt{442.33}$$

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

Therefore length of AC $= 21.03$ cm

13/



AB = 140 mm

BLADE RADIUS = 110 m

using PYTHAGORAS

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

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

$$x^2 = 7200$$

$$x = \sqrt{7200}$$

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

depth of saw exposed $= 110 - 84.85$

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

14/ $\cos^2 A + \sin^2 A = 1$

therefor $\cos^2 A = 1 - \sin^2 A$

so $\dfrac{\sin^2 A}{1-\sin^2 A} = \dfrac{\sin^2 A}{\cos^2 A} = \tan^2 A$