

March 2009 Prelim Revision - Paper 2

$$\textcircled{1} \text{ a) } 5x + 3y = 304 \quad (x \times 5) \quad 25x + 15y = 1520$$

$$2x + 5y = 209 \quad (x \times -3) \quad -6x - 15y = 627$$

b)

$$\hline 19x = 893$$

$$x = \frac{893}{19} \quad \underline{\underline{x = 47}}$$

Sub $x = 47$ in $5x + 3y = 304$

$$5(47) + 3y = 304$$

$$235 + 3y = 304$$

$$3y = 304 - 235$$

$$3y = 69$$

$$y = \frac{69}{3} \quad \underline{\underline{y = 23}}$$

Check $x = 47, y = 23$ in

$$2x + 5y = 209$$

$$2(47) + 5(23) =$$

$$94 + 115 = 209 \quad \checkmark$$

\therefore Michael will pay $3 \times 47 + 2 \times 23$
 $= \underline{\underline{\pounds 1.87}}$

$$\textcircled{2} \text{ a) } 3a + 2c = 1070 \quad (x \times 3) \quad 9a + 6c = 3210$$

$$5a + 3c = 1730 \quad (x \times -2) \quad -10a - 6c = -3460$$

$$\hline -a = -250$$

$$a = \frac{-250}{-1} \quad \underline{\underline{a = 250}}$$

Sub $a = 250$ in $3a + 2c = 1070$

$$3(250) + 2c = 1070$$

$$750 + 2c = 1070$$

$$2c = 1070 - 750$$

$$2c = 320$$

$$c = \frac{320}{2} \quad \underline{\underline{c = 160}}$$

Check $a = 250, c = 160$ in

$$5a + 3c = 1730$$

$$5(250) + 3(160) =$$

$$1250 + 480 = 1730 \quad \checkmark$$

\therefore Adults cost \pounds 2.50, children cost \pounds 1.60

$$\begin{aligned} \textcircled{2} \text{ b) } 7a + 11c &= 7(250) + 11(160) \\ &= 1750 + 1760 \\ &= 3510 \end{aligned}$$

∴ 7 adults and 11 children would cost ₦35.10

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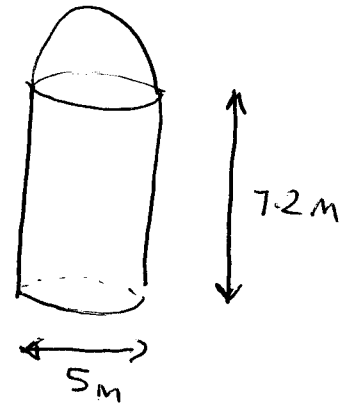
Cylinder

$$\begin{aligned} \text{Vol} &= \pi r^2 h & \text{data } h &= 7.2 \\ & & d &= 5 \\ & & r &= 2.5 \end{aligned}$$

$$V = \pi \times 2.5^2 \times 7.2$$

$$V = 141.37 \text{ m}^3$$

$$\underline{V = 141.4 \text{ m}^3 \text{ (1dp)}}$$



Hemisphere

$$\begin{aligned} V_{\text{sphere}} &= \frac{4}{3} \pi r^3 & \text{data } d &= 5 \\ & & r &= 2.5 \end{aligned}$$

$$V_{\text{sphere}} = \frac{4}{3} \times \pi \times (2.5)^3$$

$$V_{\text{sphere}} = 65.44$$

$$\therefore V_{\text{hemisphere}} = \frac{65.44}{2} = 32.72 \text{ m}^3$$

$$\underline{V_{\text{hemisphere}} = 32.7 \text{ m}^3 \text{ (1dp)}}$$

$$\begin{aligned} \therefore \text{Total volume} &= 141.4 + 32.7 \\ &= \underline{\underline{174.1 \text{ m}^3}} \end{aligned}$$

- ④ a) Volume of spheres (4 of them) equals increase of volume in tank.

Level goes up from 12cm to 14cm, increase of 2cm.

$$\text{Increase of volume} = 2 \times 25 \times 5 = 250 \text{ cm}^3$$

∴ Volume of 4 spheres is 250 cm³

b) Volume of single sphere = $\frac{250}{4} = \underline{\underline{62.5 \text{ cm}^3}}$

c) $V_{\text{sphere}} = \frac{4}{3} \pi r^3$ data $V = 62.5 \text{ cm}^3$
 $r = ?$

$$62.5 = \frac{4}{3} \pi r^3$$

$$\frac{62.5 \times 3}{(4\pi)} = r^3$$

$$r = \sqrt[3]{\frac{62.5 \times 3}{(4\pi)}} = \sqrt[3]{14.92}$$

$$r = 2.46 \text{ cm}$$

∴ The radius of the spheres is 2.5 cm (1dp)

⑤

0700

300 cm³

14% of 300

$$0.14 \times 300 = 42$$

0800

300

- 42

258

0800

258 cm³

14% of 258

$$0.14 \times 258 = 36.12$$

0900

258

- 36.12

221.88

5

0900

221.88 cm³

14% of 221.88

$$0.14 \times 221.88 = 31.06$$

1000

221.88

- 31.06

190.82

$$\therefore \text{Amount of gas lost} = 300 - 190.82 \\ = \underline{\underline{109.18 \text{ cm}^3}}$$

6 a)

Year 1
£5000

4.5% of £5000

$$0.045 \times 5000 = £225$$

5000
+ 225
£5225

Year 2
£5225

4.5% of £5225

$$0.045 \times 5225 = £235.13$$

5225
+ 235.13
£5460.13

Year 3
£5460.13

4.5% of £5460.13

$$0.045 \times 5460.13 = £245.71$$

5460.13
245.71
£5705.84

\therefore Total amount is £5705.84

$$\text{and interest earned is } £5705.84 - £5000 \\ = \underline{\underline{£705.84}}$$

b) Use formula (Not needed for exam!)

$$\begin{aligned} \text{Total} &= \text{Original amount} \times (\text{percentage change})^{\text{Years}} \\ &= 5000 \times (1.045)^{10} \\ &= 7764.85 \end{aligned}$$

\therefore Total after 10 years would be £7764.85
and interest earned is £2764.85

⑦ Reversing the change!

lost 12% so worth $100 - 12 = 88\%$

$$\therefore 88\% = \pounds 97,000$$

$$1\% = \frac{97000}{88} =$$

$$100\% = 1\% \times 100 = 100 \times \frac{97000}{88} = \pounds 110,227.27$$

\therefore The original price paid by
James was $\pounds 110,227$

⑧ a) $\frac{2}{5a} + \frac{3}{ab} = \frac{2ab + 15a}{5a \cdot ab} = \frac{a(2b + 15)}{5a^2b} = \frac{2b + 15}{5ab}$

b) $\frac{3}{(x+1)} - \frac{1}{(x-2)} = \frac{3(x-2) - 1(x+1)}{(x+1)(x-2)}$
 $= \frac{3x - 6 - x - 1}{(x+1)(x-2)} = \frac{2x - 7}{(x+1)(x-2)}$

c) $\frac{4x}{(x-1)} - \frac{x}{4} = \frac{16x - x(x-1)}{4(x-1)}$
 $= \frac{16x - x^2 + x}{4(x-1)} = \frac{17x - x^2}{4(x-1)}$

9 Area of sector = $\frac{x}{360} \times \pi r^2$

Large sector

$$A = \frac{x}{360} \times \pi r^2$$

data
 $x = 88$
 $r = 91$

$$A = \frac{88}{360} \times \pi \times 91^2$$

$$A = 6359.35$$

$$A = 6359.4 \text{ cm}^2 \text{ (1dp)}$$

Small sector

$$A = \frac{x}{360} \times \pi r^2$$

data
 $x = 88$

$$A = \frac{88}{360} \times \pi \times 55^2$$

$r = 91 - 36 = 55$

$$A = 2323.03$$

$$A = 2323.0 \text{ cm}^2 \text{ (1dp)}$$

$$\therefore \text{The shaded area} = 6359.4 - 2323.0$$
$$= \underline{\underline{4036.4 \text{ cm}^2 \text{ (1dp)}}}$$

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Sector area = $\frac{x}{360} \times \pi r^2$

Arc length = $\frac{x}{360} \times \pi d$

data

$$\text{Sector area} = 240 \text{ mm}^2$$

$$r = 25 \text{ mm}$$

use sector area formula.

$$\text{Sector area} = \frac{x}{360} \times \pi r^2$$

$$240 = \frac{x}{360} \times \pi \times 25^2$$

$$\frac{240 \times 360}{(\pi \times 25^2)} = x$$

$$x = 44.003$$

\therefore The angle x is 44.0° (3sf)

10

$$\text{arc length} = \frac{x}{360} \times \pi d$$

data

$$\begin{aligned} x &= 44 \\ r &= 25 \text{ mm} \\ d &= 50 \text{ mm} \end{aligned}$$

$$\text{arc} = \frac{44}{360} \times \pi \times 50$$

$$\text{arc} = 19.198 \text{ mm}$$

\therefore The arc length is 19.2 mm (3sf)

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Score	Frequency	Cummulative frequency	Score x Frequency
2	1	1	2
3	7	8	21
4	9	17	36
5	8	25	40
6	5	30	30
7	4	34	28
8	2	36	16
	$\Sigma 36$		$\Sigma 173$

a) Modal score is 4 (mode means most often!)

b) Median occurs in middle

$$\text{Middle of 36 numbers} \quad \frac{36+1}{2} = 18.5^{\text{th}} \text{ place}$$

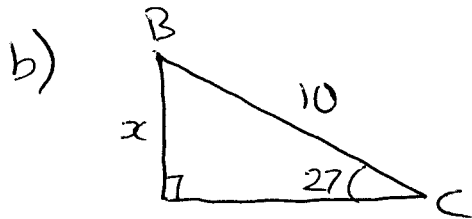
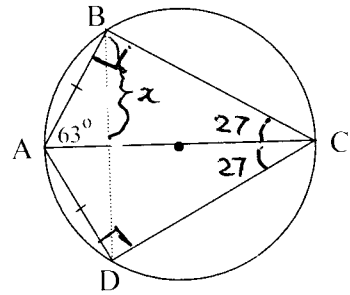
The median score is 5 (places 18-25 are all 5's)

$$\text{c) Mean} = \frac{173}{36} = 4.805$$

\therefore Mean score is 4.8 (1dp)

- ⑫ Angle ABC and angle ADC are both 90°
(formed from a diameter)

a) $\angle BCD = 54^\circ$



$$\sin 27 = \frac{x}{10}$$

$$10 \sin 27 = x$$

$$x = 4.539$$

$$x = \underline{4.5 \text{ cm (1dp)}} \quad \therefore \text{Distance BD} = 2 \times 4.5 = \underline{9 \text{ cm}}$$

⑬ a) $2x^2 + 3x - 7 = 0$
 $a=2 \quad b=3 \quad c=-7$

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

$$x = \frac{-3 \pm \sqrt{3^2 - (4 \times 2 \times -7)}}{2 \times 2}$$

$$x = \frac{-3 \pm \sqrt{9 - (-56)}}{4}$$

$$x = \frac{-3 \pm \sqrt{65}}{4}$$

Ans 1 $x = \frac{-3 + \sqrt{65}}{4} = 1.27$

$$\therefore x = \underline{1.3 \text{ (1dp)}}$$

Ans 2 $x = \frac{-3 - \sqrt{65}}{4} = -2.77$

$$\therefore x = \underline{-2.8 \text{ (1dp)}}$$

$$\textcircled{13} \text{ b) } 3x^2 = 8x - 2$$

$$3x^2 - 8x + 2 = 0$$

$$a=3 \quad b=-8 \quad c=2$$

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

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - (4 \times 3 \times 2)}}{2 \times 3}$$

$$x = \frac{8 \pm \sqrt{64 - (24)}}{6}$$

$$x = \frac{8 \pm \sqrt{40}}{6}$$

$$\text{Ans 1} \quad x = \frac{8 + \sqrt{40}}{6} = 2.39$$

$$\therefore \underline{\underline{x = 2.4 \text{ (1dp)}}}$$

$$\text{Ans 2} \quad x = \frac{8 - \sqrt{40}}{6} = 0.28$$

$$\therefore \underline{\underline{x = 0.3 \text{ (1dp)}}}$$

$$\text{c) } x(5x-1) = 3$$

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

$$5x^2 - x - 3 = 0$$

$$a=5 \quad b=-1 \quad c=-3$$

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

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - (4 \times 5 \times -3)}}{2 \times 5}$$

$$x = \frac{1 \pm \sqrt{1 - (-60)}}{10}$$

$$x = \frac{1 \pm \sqrt{61}}{10}$$

$$\text{Ans 1} \quad x = \frac{1 + \sqrt{61}}{10} = 0.88$$

$$\therefore \underline{\underline{x = 0.9 \text{ (1dp)}}}$$

$$\text{Ans 2} \quad x = \frac{1 - \sqrt{61}}{10} = -0.68$$

$$\therefore \underline{\underline{x = -0.7 \text{ (1dp)}}}$$

4, 9, 16, 25, 36, 49, 64, 81, 100

14) a) $\sqrt{75} + 2\sqrt{3} - \sqrt{48}$
 $= 5\sqrt{3} + 2\sqrt{3} - 4\sqrt{3}$
 $= \underline{\underline{3\sqrt{3}}}$

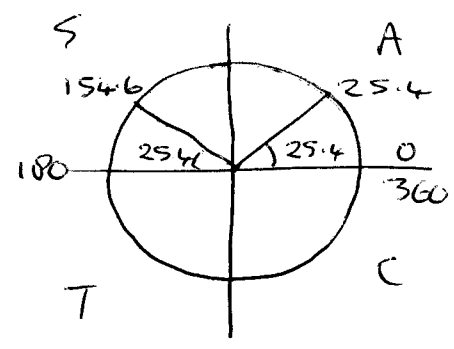
$\sqrt{75} = \sqrt{25 \times 3} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$
 $\sqrt{48} = \sqrt{16 \times 3} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$

b) $\sqrt{128} - \sqrt{2} + \sqrt{18}$
 $= 8\sqrt{2} - \sqrt{2} + 3\sqrt{2}$
 $= \underline{\underline{10\sqrt{2}}}$

$\sqrt{128} = \sqrt{64 \times 2} = \sqrt{64} \times \sqrt{2} = 8\sqrt{2}$
 $\sqrt{18} = \sqrt{9 \times 2} = \sqrt{9} \times \sqrt{2} = 3\sqrt{2}$

15) a) $7 \sin x = 3$
 $\sin x = \frac{3}{7}$

Acute angle = $\sin^{-1}\left(\frac{3}{7}\right)$
 $= \underline{\underline{25.4^\circ}}$ (1dp)

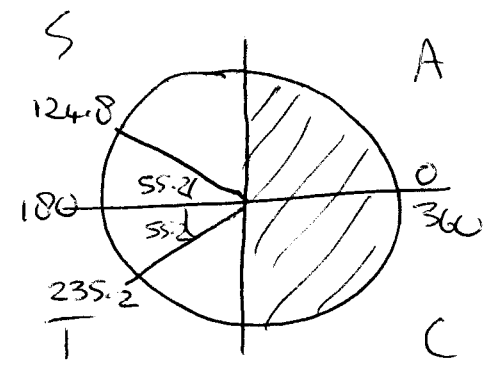


\therefore Solutions are $x = 25.4^\circ, 154.6^\circ$

b) $7 \cos x - 3 = -7$
 $7 \cos x = -7 + 3$
 $7 \cos x = -4$

$\cos x = \frac{-4}{7}$ (lose the -ve)

Acute angle = $\cos^{-1}\left(\frac{4}{7}\right)$
 $= 55.15$
 $= \underline{\underline{55.2^\circ}}$ (1dp)



\therefore Solutions are $x = 124.8^\circ, 235.2^\circ$

(15) c) $\sqrt{2} \tan x = 10$

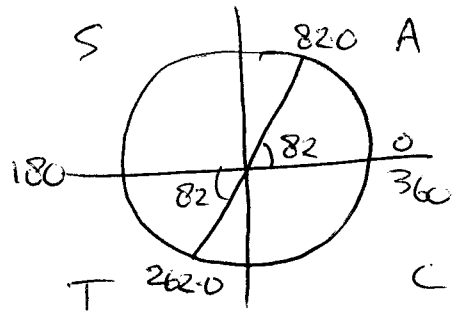
$$\tan x = \frac{10}{\sqrt{2}}$$

$$\text{Acute angle} = \tan^{-1}\left(\frac{10}{\sqrt{2}}\right)$$

$$= 81.95$$

$$= \underline{\underline{82.0 \text{ (1dp)}}}$$

\therefore Solutions are $x = \underline{\underline{82.0^\circ, 262.0^\circ}}$



d) $6 \tan x - 2.5 = 9.8$

$$6 \tan x = 9.8 + 2.5$$

$$6 \tan x = 12.3$$

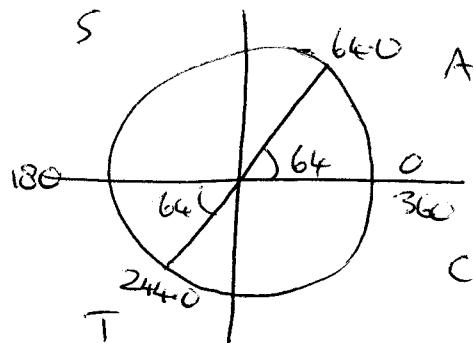
$$\tan x = \frac{12.3}{6}$$

$$\text{Acute angle} = \tan^{-1}\left(\frac{12.3}{6}\right)$$

$$= 63.99$$

$$= \underline{\underline{64.0^\circ \text{ (1dp)}}}$$

\therefore Solutions are $x = \underline{\underline{64.0^\circ, 244.0^\circ}}$



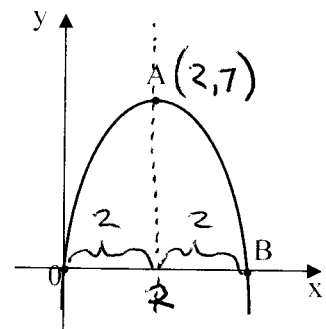
(16) $y = 7 - (x-2)^2$

or $y = -(x-2)^2 + 7$

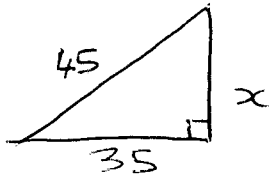
a) T.P at $(2, 7)$

b) Axis of sym $x = 2$

c) By symmetry, B is $(4, 0)$



(17)



Pythagoras

$$h^2 = a^2 + b^2$$

$$45^2 = x^2 + 35^2$$

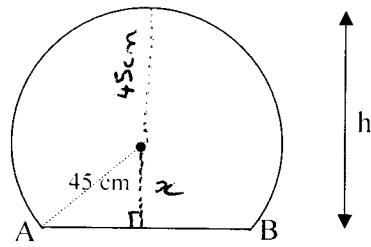
$$45^2 - 35^2 = x^2$$

$$x^2 = 800$$

$$x = \sqrt{800}$$

$$x = 28.28$$

$$x = \underline{\underline{28.3 \text{ cm (1dp)}}}$$

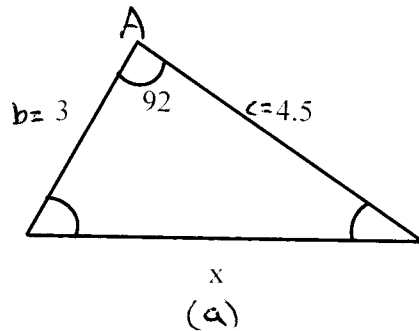


$$\therefore \text{Height, } h = 45 + 28.3$$

$$= \underline{\underline{73.3 \text{ cm}}}$$

(18)

No side/angle pairs
so cosine rule!



a)

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

$$x^2 = 3^2 + 4.5^2 - (2 \times 3 \times 4.5 \times \cos 92)$$

$$x^2 = 29.25 - (-0.9423)$$

$$x^2 = 30.1923$$

$$x = \sqrt{30.1923}$$

$$x = 5.494 \quad \therefore x = \underline{\underline{5.49 \text{ (to 2dp)}}}$$

b) Area = $\frac{1}{2} ab \sin C$

$$= \frac{1}{2} \times 3 \times 4.5 \times \sin 92 = 6.745$$

$$\text{Area} = \underline{\underline{6.75 \text{ square units (3sf)}}}$$