

24. (a) (i) Area of base x^2
Or Area of sides = $4xh$

$$x^2 + 4xh = 432$$

$$h = \frac{432 - x^2}{4x}$$

(ii) Vol. = x^2h
= $x^2 \left(\frac{432 - x^2}{4x} \right)$

(ii) Vol = $108x - \frac{1}{4}x^3$

$$\frac{dv}{dx} = 108 = \frac{3}{4}x^2$$

$$108 - \frac{3}{4}x^2 = 0$$

$$x = 12$$

(iii) Vol. = $108x - \frac{1}{4}x^3$
= $108 \times 12 - \frac{1}{4} \times 12^3$
= 864 cm^3

(1 marks)

30.3.2 Mathematics Paper 2 (121/2)

1.
$$\frac{(7.55 \times 5.25) - (7.45 \times 5.15)}{2 \times 7.5 \times 5.2} \times 100 = 1.628$$

(3 marks)

2.
$$\frac{4}{\sqrt{5} + \sqrt{2}} - \frac{3}{\sqrt{5} - \sqrt{2}}$$

=
$$\frac{4(\sqrt{5} - \sqrt{2}) - 3\sqrt{5} + \sqrt{2}}{(\sqrt{5} + \sqrt{2})(\sqrt{5} - \sqrt{2})}$$

=
$$\frac{4\sqrt{5} - 4\sqrt{2} - 3\sqrt{5} - 3\sqrt{2}}{3}$$

=
$$\frac{\sqrt{5} - 7\sqrt{2}}{3}$$

(3 marks)

3. $\angle OCT = 36^\circ$ (Alt. \angle s equal)
 $\angle OTC = 36^\circ$ (Base \angle s of isosceles Δ)
 $\angle CTB = 90^\circ - 36^\circ = 54$

(3 marks)

4. Let ratio x to y be a:b

$$\frac{68a + 53b}{a + b} = 62$$

$$\Rightarrow 6a = 9b$$

$$\therefore a : b = 9 : 6$$

$$= 3 : 2$$

(2 marks)

5. Let the width be x m

$$\text{Length} = 2x - 2$$

$$\text{Area} = (2x - 2)x = 60$$

$$x^2 - x - 30 = 0$$

$$(x - 6)(x + 5) = 0$$

$$x = 6$$

$$\therefore \text{length} = 2 \times 6 - 2 = 10 \text{ cm}$$

(3 marks)

6. One person can build $\frac{1}{5} \times 3$ huts in 21 days.

10 people can build 6 huts in 21 days.

x people can build 6 huts in 15 days

$$x = \frac{21}{15} \times 10 = 14 \text{ people}$$

(2 marks)

7. $R = \frac{3800 \times 100}{40000 \times 5} = 1.9\%$

$$A = \frac{3940 \times 100}{7.5 \times 1.9} = 24000$$

(3 marks)

8. Upper quartile = $49.5 \times \frac{5}{20} \times 10 = 52$

$$\text{Lower quartile} = 19.5 + \frac{16}{10} \times 10 = 29.5$$

$$\text{Quartile deviation} = \frac{52 - 29.5}{2} = 11.25$$

(4 marks)

$$9. \quad P(ww) = \frac{2}{5} \times \frac{1}{4} = \frac{1}{10}$$

$$P(bb) = \frac{2}{7} \times \frac{1}{6} = \frac{1}{21}$$

(2 marks)

$$10. \quad (a) \quad \begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3+2k \\ 2 \end{pmatrix}$$

$$x \text{ ordinate} = 3+2k$$

$$(b) \quad 3+2k=4 \Rightarrow k = \frac{1}{2}$$

$$\text{Or} \quad 3+2k=0 \Rightarrow k = \frac{-3}{2}$$

(4 marks)

$$11. \quad (a) \quad S = \frac{3}{2}t^2 - \frac{1}{3}t^3 + C$$

$$(b) \quad \text{When } t=0, s=0$$

$$\therefore C=0$$

$$S = \frac{3}{2}t^2 - \frac{1}{3}t^3 = 0$$

$$t^2 \left(\frac{3}{2} - \frac{1}{3}t \right) = 0$$

$$t=0 \quad \text{Or} \quad t=4.5$$

$$t=4.5$$

(4 marks)

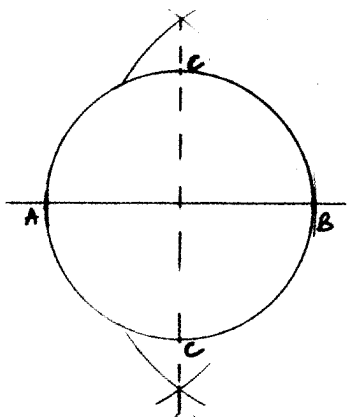
$$12. \quad (a) \quad \begin{aligned} (2-x)^5 &= 2^5 - 5(2)^4 x + 10(2)^3 x^2 \\ &\quad - 10(2)^2 x^3 + 5(2)x^4 - x^5 \\ &= 32 - 80x + 80x^2 - 40x^3 + 10x^4 - x^5 \end{aligned}$$

$$(b) \quad (2-0.2)^5 = 32 - 80(0.2) + 80(0.2)^2 - 40(0.2)^3$$

$$= 32 - 16 + 3.2 - 0.32 = 18.88$$

(4 marks)

13.



- (a) Locus of P
 (b) \perp bisector of AB
 Positions of CV indicated

(3 marks)

14.
$$3y - y = \frac{p}{q + \frac{1}{x}}$$

$$2y \left(q + \frac{1}{x} \right) = p$$

$$q + \frac{1}{x} = \frac{p}{2y}$$

$$\frac{1}{x} = \frac{p}{2y} - q$$

$$x = \frac{2y}{p - 2yq}$$

(3 marks)

15.
$$\log \left(\frac{15 - 5x}{10} \right) = \log 3x - 2$$

$$\frac{15 - 5x}{10} = 3x - 2$$

$$15 - 5x = 30x - 20$$

$$x = 1$$

(3 marks)

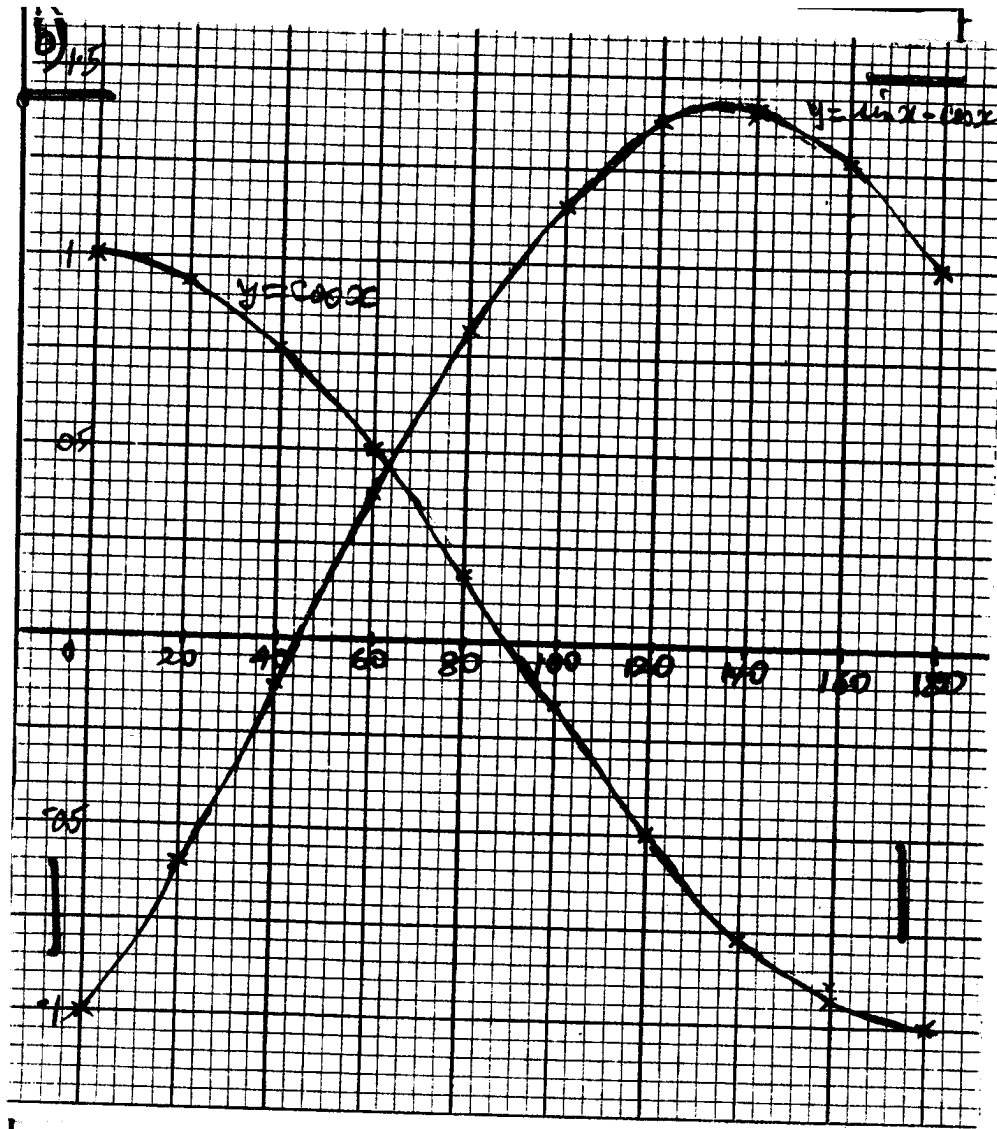
16. (a) Coordinates of centre (1, -1)
 Radius: $r^2 = 1^2 + 3^2 = 10 \Rightarrow r = \sqrt{10}$

- (b) Equation
 $(x - 1)^2 + (y + 1)^2 = 10$
 $x^2 - 2x + 1 + y^2 + 2y + 1 = 10$
 $x^2 + y^2 - 2x + 2y = 8$

(4 marks)

17.

x°	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
$\cos x^\circ$					0.17		-0.5		-0.94	
$\sin x^\circ - \cos x^\circ$			-0.13			1.15		1.41		



- (c) (i) $\sin x^\circ - \cos x^\circ = 1.2$
 $x^\circ = 104,166$
- (ii) $\cos x^\circ = \frac{1}{2} \sin x^\circ$
 $\Rightarrow \cos x^\circ = \sin x^\circ - \cos x^\circ = 63^\circ$
- (iii) $\cos 63^\circ = 0.45$

(10 marks)

18. (a) $OB = 3p + 3r$
 $AJ = 2p + 2r$
- (b) $OX = m(OB) = m(3p + 3r)$
 $OX = 2r + p + n(2p - 2r)$

(iii) $m(3p+3r) = 2r-2nr+p+2np$
 $3mp+3mr = r(2-2n)+p(1+2n)$
 $3mp = (1+2n)p$
 $3m = 1+2n$ (i)
 $3mr = r(2-2n)$
 $3m = 2-2n$ (ii)

$$1-2n = 2-2n$$

$$4n = 1 \Rightarrow n = \frac{1}{4}$$

Subst. for $n = \frac{1}{4}$ in (i)

$$3m = 1 + 2 \times \frac{1}{4}$$

$$3m = 1\frac{1}{2} \Rightarrow m = \frac{3}{2 \times 3} = \frac{1}{2}$$

The ratio in which x divides AJ

$$AX = nAJ = \frac{1}{4}AJ$$

Ratio 1 : 3

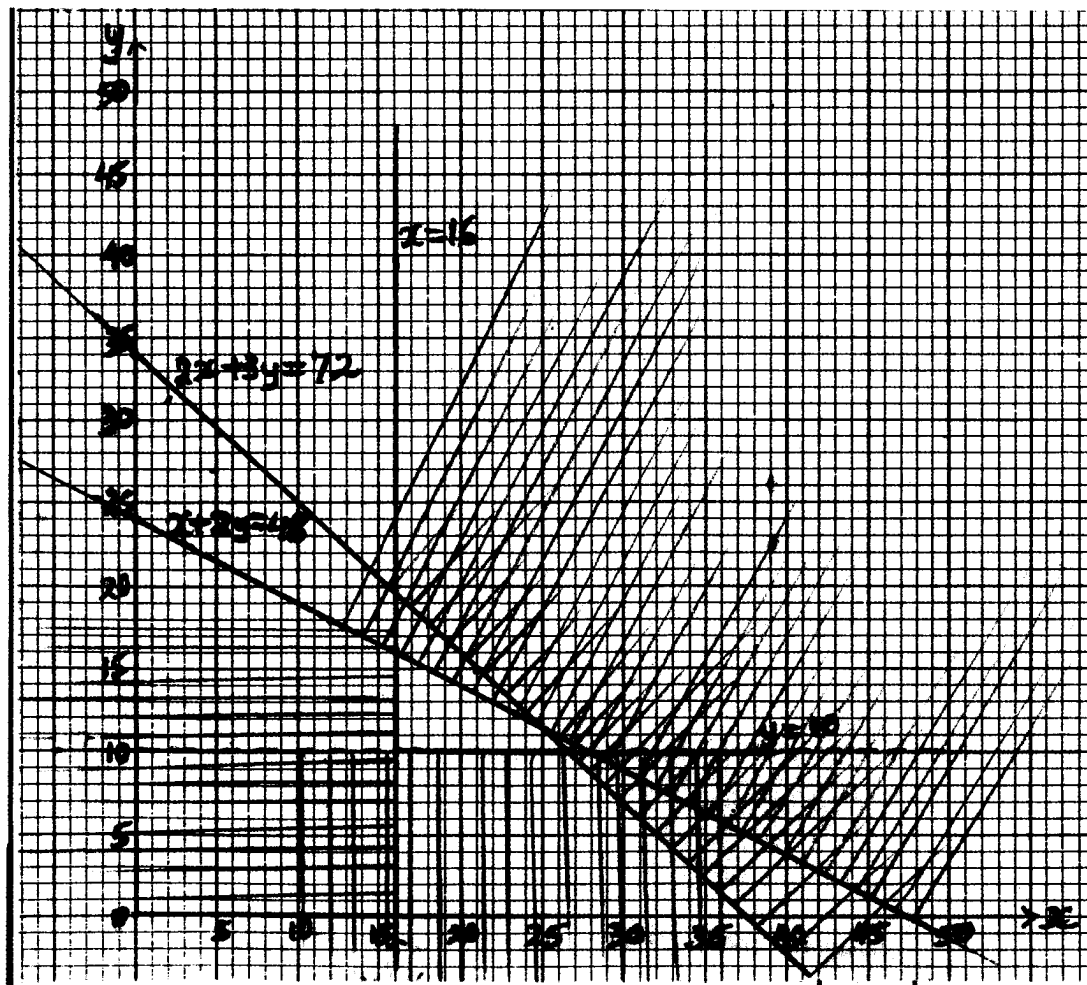
19. (a) (i) Angle subtended (longitude) (10 marks)
 $16 + 24 = 40^\circ$
Arc AB = $60 \times 40 \times \cos 34^\circ$
= $1989.69 \approx 1990 \text{ nm}$
- (ii) Arc AC : latitude difference
= $26 + 24 = 60$
 \therefore Arc AC = $60 \times 60 \text{ nm} = 3600$
- (b) (i) local time at B
 $1330 + \frac{40}{15} \text{ h}$
 $1330 + 2\text{h}40 \text{ min}$
 1610h
- (ii) time taken to travel from A to B
 $= \frac{1990}{40} = 49\text{h}45 \text{ min.}$

Time of arrival:
 Wednesday at 1610 + 1h 45 min
 = Wednesday 1755h

(10 marks)

20. (a) $4x + 6y \geq 144$
 $100x + 200y \leq 4800$
 $x \geq 16$
 $y > 10$

(b)



$2x + 3y \geq 72$ drawn and shaded
 $x + 2y \leq 48$ drawn and shaded
 $x \geq 15$
 $y > 10$

- (c) At least 2 points on vertical axis inspected
 Substituting in equation

$$\begin{aligned}
 p &= 40 \times 100, y = 40 \times 16 + 100 \times 16 \\
 &= 640 + 1600 = 2240
 \end{aligned}$$

(10 marks)

21. (a) Let number of rows be r and number of persons per row be p

$$\begin{aligned}
 pr &= 600 \Rightarrow p = \frac{600}{r} \\
 (r+5)(p-6) &= 600 \\
 (r+5)\left(\frac{600}{r} - 6\right) &= 600 \\
 (r+5)(600 - 6r) &= 600r \\
 600r - 6r^2 + 3000 - 30r &= 600r \\
 r^2 + 5r - 500 &= 0 \\
 (r+25)(r-20) &= 0 \\
 r &= 20
 \end{aligned}$$

- (b) No. of rows in new arrangement
 $20 + 25 = 25$

No. of empty spaces per row with 450 people seated

$$\frac{600 - 450}{45} = 6$$

22. (a)

(10 marks)

$$\begin{aligned}
 T_6 &= p + 5c \\
 T_5 &= p + 4d \\
 p + 4d &= p + 5c \\
 4d &= 5c \\
 d &= \frac{5}{4}c
 \end{aligned}$$

- (b)

$$\begin{aligned}
 p + 3d - (p + 3c) &= 1\frac{1}{2} \\
 3d - 3c &= 1\frac{1}{2} \\
 \frac{15}{4}c - 3c &= 1\frac{1}{2} \\
 \frac{3}{4}c = \frac{3}{2} &\Rightarrow c = 2 \\
 d &= 2\frac{1}{2}
 \end{aligned}$$

(c)

$$S_1 = \frac{1}{2}n(a + \ell) = \frac{1}{2}n(2p + 10) \\ = 3(2p + 10) = 6p + 30$$

$$S_2 = \frac{1}{2}n(2p + 10) = 2.5(2p + 10) = 5p + 25 \\ (6p + 30) - (5p + 25) = 10 \\ p + 5 = 10 \\ p = 5$$

(10 marks)

23. (a)

$$5 = k_1t + k_2t^2 \\ 80 = 2k_1 + 4k_2 \dots\dots\dots(i) \\ 135 = 3k_1 + 9k_2 \dots\dots\dots(ii)$$

$$(ii) \times 2 \Rightarrow 270 = 6k_1 + 18k_2 \\ (i) \times 3 \Rightarrow \frac{\pm 240 = \pm 6k_1 \pm 12k_2}{30 = 6k_2 \Rightarrow k_2 = 5}$$

Substitute for k_2 in (i)

$$80 = 2k_1 + 4 \times 5 \\ 60 = 2k_1 \Rightarrow k_1 = 30$$

Expression: $S = 30t + 5t^2$

(b) (i) distance when $t = 5$ seconds
 $S = 30 \times 5 + 5 \times 25 = 275$

(ii)

$$560 = 30t + 5t^2 \\ 5t^2 + 30t - 560 = 0 \\ t + 6 - 112 = 0 \\ (t + 14)(t - 8) = 0 \\ \text{Time taken, } t = 8 \text{ seconds}$$

(10 marks)

24. (a) (i)

$$\angle OSR = 90 - 50 = 40 \\ \therefore \angle ORS = 40$$

(ii) $\angle RTS = 30^\circ$ and $\angle RPS = 50^\circ$
 $\therefore \angle USP = 30^\circ + 50^\circ = 80^\circ$

(iii) $\angle PQR = 180^\circ - 50^\circ = 130^\circ$

(b) (i)

$$PT \times TR = TS^2$$

$$(7 + x)(7) = 9^2$$

$$7x = 81 - 49 = 32$$

$$x = \frac{32}{7} = 4.57$$

(ii)

$$\angle ORP = 40^\circ$$

$$\cos 40^\circ = \frac{\frac{1}{2} \times 4.57}{r}$$

$$r = \frac{\frac{1}{2} \times 4.57}{\cos 40} = 2.98$$

(10 marks)

30.3.3 Mathematics Alt. B Paper 1 (122/1)

1. $270 \div (90 \times 2) + 7 \times 4 - 40 \div 5$
 $= 270 \div 180 + 28 - 8$
 $= 21 \frac{1}{2}$

2 marks

2. $7056 = 2^4 \times 3^2 \times 7^2$
 $\sqrt{7056} = 2^2 \times 3 \times 7$
 $= 84$

2 marks

3. $\frac{2(-2) + 3(3+5)}{4 \times 3 \times 5}$
 $= \frac{-4 + 24}{60}$
 $= \frac{1}{3}$

2 marks