MANYAM FRANCHISE
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1. $\dfrac{-2(5+3-9 \div 3+5}{-3 \times {}^-5 + ({}^-2) \times 4} = \dfrac{-14}{7} = -2$

(3marks)

2.   Total fraction $\dfrac{3}{8} + \dfrac{2}{5} = \dfrac{31}{40}$

Remaining fraction $= \dfrac{9}{40}$

Original amount $= $ Sh. $12,330 \times \dfrac{40}{9}$

                          $= $ Sh. $54,800$

Tatu's fees $= $ Sh. $\dfrac{2}{5} \times 54800$

                          $= $ Sh. 21920

(4 marks)

3.   Gradient $= -\dfrac{1}{2}$

$\dfrac{y+2}{x-3} = -\dfrac{1}{2}$

$y = -\dfrac{1}{2}x - \dfrac{1}{2}$

(3 marks)

4.   Let the distance be d km

$\dfrac{d}{75} \, or \, \dfrac{d}{95}$

$\dfrac{d}{75} - \dfrac{d}{95} = \dfrac{20}{60}$

$d = 118.75 km$

(3 marks)

5.   Let odd integers be

$x, \ (x+2), \ (x+2+2)$
$x + (x+2) + (x+2+2) > 219$
$\qquad\qquad 3x > 213$
$\qquad\qquad x > 71$
The numbers are 73, 75, 77

6.   (a)   Sh. 77.24 x 100,000
                =   sh. 7 724 000

      (b) $\dfrac{Sh..77.24 \times 100000}{122.27}$

                =   Sh. 63 172

7. $RQ = -r + P + \dfrac{1}{3}r$

        $= P - \dfrac{2}{3}r$

      $OM = r + \dfrac{1}{2}(P - \dfrac{2}{3}r)$

        $= \dfrac{2}{3}r + \dfrac{1}{2}P$

8. $27^{\frac{2}{3}} \times \left(\dfrac{81}{16}\right)^{-\frac{1}{4}} = \left(3^3\right)^{\frac{2}{3}} \times \left(\dfrac{3^4}{2^4}\right)^{-\frac{1}{4}}$

                $= 3^2 \times \left(\dfrac{3}{2}\right)^{-1}$

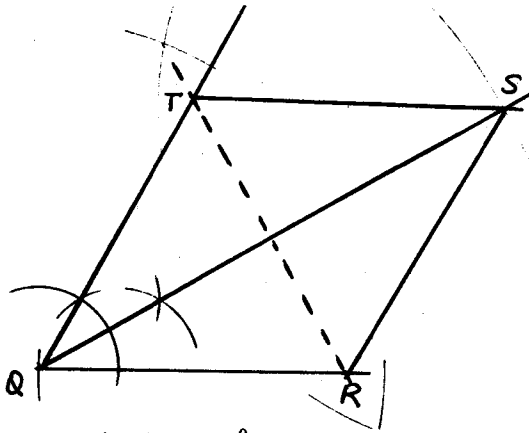 $= 3^2 \times \dfrac{2}{3}$

                $= 6$

9.

435

10.
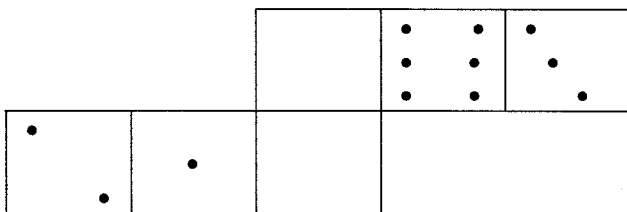
∠ TQR = 60⁰, QS = 10cm and bisects ∠ TQR

Mediator of QS drawn or ∠ RSQ = ∠ QST = ∠ RQS

Rhombus completed

<div align="right">(3 marks)</div>

11.   No. Of oranges for Friday
$$1948 - (650 + 750 + 240)$$
$$= \quad 208$$

No. Of oranges for Saturday
$$208 + 560$$
$$= \quad 768$$

Amount   = Sh. 8 x 768
= Sh. 6,144

<div align="right">(4 marks)</div>

12. $$\frac{x^2 + x - 4xy - 4y}{(x+1)(4y^2 - xy)} = \frac{x(x+1) = 4y(x+1)}{(x+1)(y)(4y - x)}$$

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

$$= -\frac{1}{y}$$

<div align="right">(3 marks)</div>

13.   Sin 3θ = cos 2θ
Sin 3θ = Sin $(90^0 - 2\theta)$
$3\theta = 90^0 - 2\theta$
$5\theta = 90^0$
$\theta = 18^0$

<div align="right">(3 marks)</div>

436

14. $2\pi r^2 + 2\pi rh = 154$

$r = h$

$2\pi r^2 + 2\pi r^2 = 154$

$2\pi r^2 = 154$

$r = \sqrt{\dfrac{154}{4 x 3.142}}$

$= 3.500$

$d = 2r = 3.500 x 2$

$= 7.00$

(3 marks)

15.   Let OC = r

$\therefore CD = \dfrac{2}{3}r$ and $EF = \dfrac{2}{3}\big((r+5)\big)$

$\dfrac{2}{3}r + \dfrac{2}{3}(r+5) + 5 + 5 = 24$

$\dfrac{4}{3}r = 10\dfrac{2}{3}$

$r = 8$

(3 marks

16.

Heights (cm) of seedlings
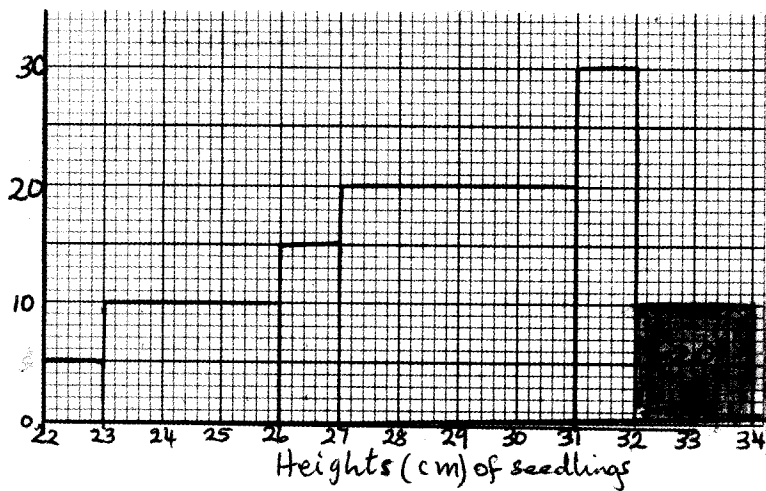
Total No. of seedlings
$= 5 \times 1 + 10 \times 3 + 15 \times 1 + 20 \times 4 + 30 \times 1 + 10 \times 2$

$= 5 + 30 + 15 + 80 + 30 + 20$

$= 180$

% height $h : 23 \le h \angle 27$

= $\left(\dfrac{30+15}{180}\right) \times 100\%$ =   25%   (3 marks)

437

SECTION II

17. (a) Total sales $\quad = \quad$ Sh. 360×500

$\qquad\qquad\qquad = \quad$ Sh. 180,000

Commission $\quad = \quad$ Sh $\left(180000 - 100000\right) \times \dfrac{2}{100} \quad = \quad$ Sh 1600

Total earnings $\quad = \quad$ Sh $\left(12000 + 1600\right) = $ Sh 13600

(b) (i) New salary $\quad = \quad$ Sh $12000 + 12000 \times \dfrac{10}{100}$

$\qquad\qquad\qquad$ Or $\quad$ Sh $12000 \times \dfrac{110}{100} = $ Sh 13200

Commission paid $= \quad$ sh $\left(17600 - 13200\right) = $ Sh 4400

Commission is paid on Sh $4400 \times \dfrac{100}{2} = $ Sh 220000

Total sales $\quad = \quad$ Sh $220000 + 100000 = 320000$

No. of bags sold $\quad = \quad \dfrac{320000}{500} = \quad 640$

$\hfill$ (10 marks)

18. (a) (i) Int. vol. of the box $\quad = 150 \times 80 \times 40 cm^3$

$\qquad\qquad\qquad\qquad\qquad = 480000 cm^3$

Ext. Vol. $\quad = 152 \times 82 \times 42 cm^3$

$\qquad\qquad\quad = 523488 cm^3$

Vol. of wood $\quad = 523488 - 480000$

$\qquad\qquad\qquad = 43488 cm^3$

(ii) Mass of box $\quad = \dfrac{43488 \times 0.6}{1000}$

$\qquad\qquad\qquad\qquad = 26.0928$

$\qquad\qquad\qquad\qquad = 26.1$

(b) (i) No. of tins $\quad = \dfrac{150}{10} + \dfrac{80}{10} + \dfrac{40}{20} = 240$

(ii) Total mass $\quad = 26.1 + \dfrac{240 \times 120}{1000} = 54.9 kg$

$\hfill$ (10 marks)

438

19. (a) Det $|45 - 42| = 3$

Inverse $A^{-1} = \dfrac{1}{3}\begin{pmatrix} 9 & {}^-6 \\ {}^-7 & 5 \end{pmatrix}$

(b) (i)

$$\begin{pmatrix} 5 & 6 \\ 7 & 9 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 & 4 & 4 & 0 \\ 3 & 5 & 6 & 0 \end{pmatrix}$$

(ii)

$$\begin{pmatrix} 5 & 6 \\ 7 & 9 \end{pmatrix}\begin{pmatrix} 3 & {}^-2 \\ \dfrac{{}^-7}{3} & \dfrac{5}{3} \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 & {}^-2 \\ \dfrac{{}^-7}{3} & \dfrac{5}{3} \end{pmatrix}\begin{pmatrix} 2 & 4 & 4 & 6 \\ 3 & 5 & 6 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 3 \times 2440 - 2 \times 3560 \\ \dfrac{{}^-7}{3} \times 2440 + \dfrac{5}{3} \times 3560 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 200 \\ 240 \end{pmatrix}$$

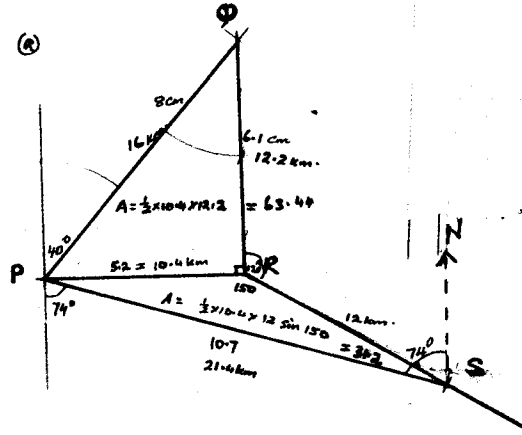(c) Total cost of books $\quad = \quad 36 \times 200 + 50 \times 240 = 19200$

Total cost with discount

$$= \quad \frac{36 \times 200 \times 95}{100} + \frac{50 \times 200 \times 92}{100} = 17880$$

% discount $\quad = \quad \left(\dfrac{19200 - 17880}{19200}\right) \times 100 = 6.875\%$

(10 marks)

439

20.

(b) (i) Distance of P from S = 10.7 cm
                              = 21.4 km

(ii) Angle PSN   = 74^0
      Bearing of P from S   = 286^0

(c) Area of $\Delta PQR = \dfrac{1}{2} \times 10.4 \times 12.2 = 63.44 km^2$

Area of $\Delta PRS = \dfrac{1}{2} \times 10.4 \times 12 \sin 150 = 31.2 km^2$

Area of ranch PORS = 63.44 + 31.2 = 96.64 km²

(10 marks)

21. (a) (i) A takes $\dfrac{180}{x+10}$

(ii) B takes $\dfrac{180}{x}$

(b) $\dfrac{180}{x} - \dfrac{180}{x+10} = \dfrac{3}{2}$

$180(x+10) - 180x = \dfrac{3}{2}x(x+10)$

$360(x+10) - 360x = 3x(x+10)$

$360x + 3600 - 360x = 3x^2 + 30x$

$x^2 + 10x - 1200 = 0$

$(x-30)(x+40) = 0$

$x = 30$ or $x = -40$

Speed of A = 30+10=40

440

(c)   Time taken by A = $\dfrac{48}{40} \times 60 = 72\,\text{min}$

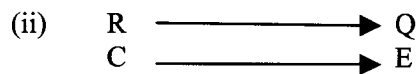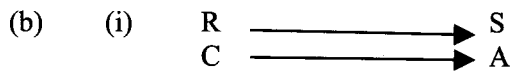Time taken by B = $\dfrac{48}{30} \times 60 = 96\,\text{min}$

Time for B   = 96 - 10 = 86 min

Difference in time   =   86 – 72 min
                                    =   14 min

(10 marks)

22.   (a)   (i)   Reflection in the line PR or ER

                (ii)   Enlargement centre E
                        Scale factor = -1

                (iii)   Rotation about point R through 90^0 clockwise

    (b)   (i)   R $\longrightarrow$ S
                            C $\longrightarrow$ A

                (ii)   R $\longrightarrow$ Q
                              C $\longrightarrow$ E

(10 marks)

23.

No. of Kgs of meat	Frequency (f)	Mid-points (x)	Fx	CF
1 – 5	2	3	6	2
6 – 10	3	8	24	5
11 – 15	6	13	78	11
16 – 20	8	18	144	19
21 – 25	3	23	69	22
26 – 30	2	28	56	24
31 – 35	1	33	33	25
	$\sum f = 25$		$\sum fx = 410$	

(a)   Modal frequency = 8

(b)   Mean = $\dfrac{410}{25}$ = 16.4

(c)   CF: 2, 5, 11, 19, 22, 24, 25
        Median = $15.5 + \dfrac{2}{8} \times 5$ = 16.75

(10 marks)

441

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. $= x^2 h$

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

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

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

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

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

(3 marks)

3. $\angle OCT = 36^0$ (Alt. $\angle s$ equal)

   $\angle OTC = 36^0$ (Base $\angle s$ of isosceles Δ)

   $\angle CTB = 90^0 - 36^0 = 54$

   (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

   Length $=$ $2x - 2$

   Area $=$ $(2x - 2)x = 60$

   $x^2 - x - 30 = 0$

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

   $x = 6$

   $\therefore$ length $= 2 \times 6 - 2 = 10$ 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. $R = \dfrac{3800 \times 100}{40000 \times 5} = 1.9\%$

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

   (3 marks)

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

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

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

   (4 marks)

443

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

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

<div align="right">(2 marks)</div>

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

         x ordinate $= 3+2k$

     (b) $3 + 2k = 4 \implies k = \dfrac{1}{2}$

         Or $3 + 2k = 0 \implies k = \dfrac{-3}{2}$

<div align="right">(4 marks)</div>

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

     (b)   When t = 0, s = 0

         $\therefore$ C = 0

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

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

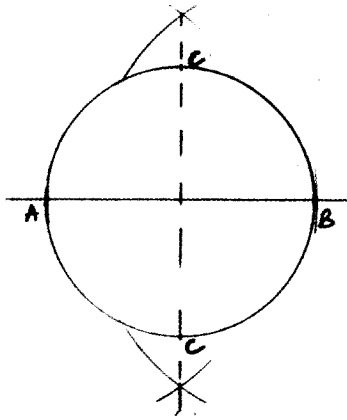 $t = 0 \quad Or \quad t = 4.5$

               $t = 4.5$

<div align="right">(4 marks)</div>

12.   (a) $(2-x)^5 = 2^5 - 5(2)^4 x + 10(2)^3 x^2$

               $-10(2)^2 x^3 + 5(2)x^4 - x^5$

              $= 32 - 80x + 80x^2 - 40x^3 + 10x^4 - x^5$

     (b) $(2 - o.2)^5 = 32 - 80(0.2) + 80(0.2)^2 - 40(0.2)^3$

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

<div align="right">(4 marks)</div>

13.

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

(3 marks)

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

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

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

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

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

(3 marks

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

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

       $15 - 5x = 30x - 20$

       $x = 1$

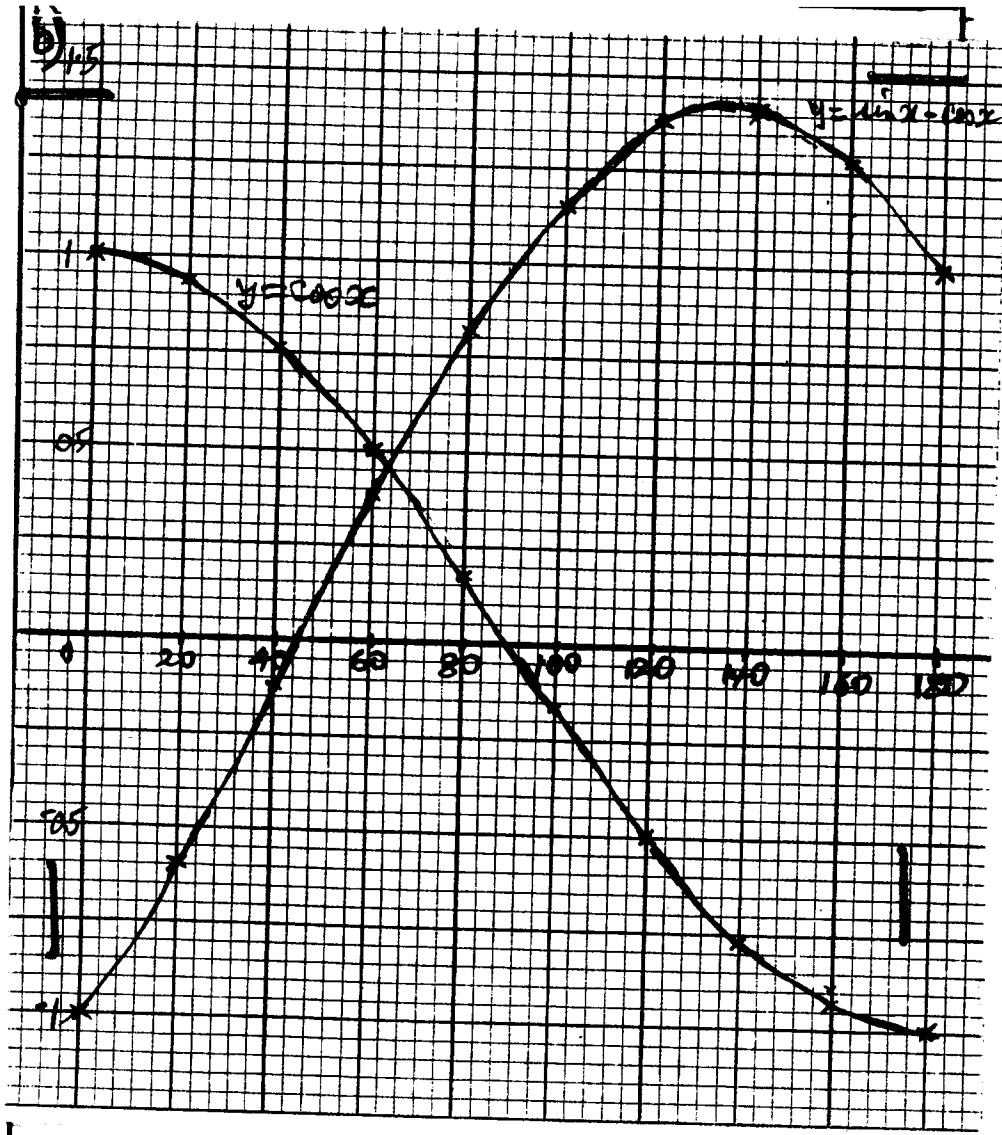(3 marks)

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

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

(4 marks)

445

17.

x^0	0^0	20^0	40^0	60^0	80^0	100^0	120^0	140^0	160^0	180^0
$Cos\,x^0$					0.17		-0.5		-0.94	
$Sin\,x^0 - Cos\,x^0$			-0.13			1.15		1.41		

(c) (i) $\sin x^0 - \cos x^0 = 1.2$

$x^0 = 104, 166$

(ii) $\cos x^0 = \dfrac{1}{2}\sin x^0$

$\Rightarrow \cos x^0 = \sin x^0 - Cos\,x^0 = 63^0$

(iii) $\cos 63^0 = 0.45$

(10 marks)

446

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)

$1-2n = 2-2n$

$4n = 1 \implies n = \dfrac{1}{4}$

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

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

$3m = 1\dfrac{1}{4} \implies m = \dfrac{3}{2 \times 3} = \dfrac{1}{2}$

The ratio in which x divides AJ

$AX = nAJ = \frac{1}{4}AJ$
Ratio   1 : 3

                                                      (10 marks)

19.   (a)   (i)   Angle subtended (longitude)
$16 + 24 = 40^0$
Arc AB $= 60 \times 40 \times \cos 34^0$
                 $= 1989.69 \approx 1990\ nm$

          (ii)   Arc AC : latitude difference
            $=$ $26 + 24 = 60$
            $\therefore$ Arc AC $= 60 \times 60\ nm = 3600$

     (b)   (i)   local time at B

$1330 + \dfrac{40}{15}h$

$1330 + 2h40\min$

$1610h$

          (ii)   time taken to travel from A to B
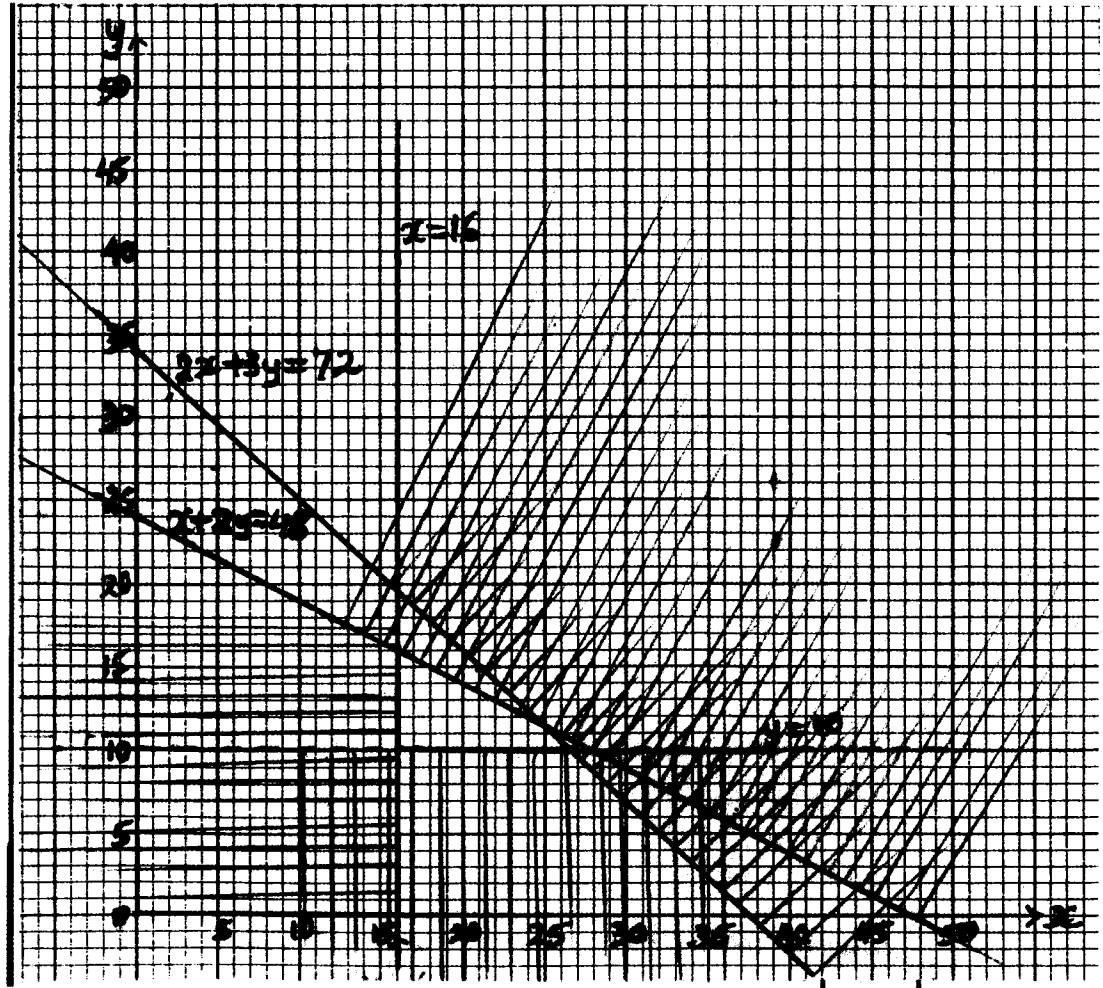
$= \dfrac{1990}{40} = 49h45\min.$

447

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

448

$$p = 40x100y = 40 \times 16 + 100 \times 16$$
$$= 640 + 1600 = 2240$$

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

$$pr = 600 \Rightarrow p = \frac{600}{r}$$

$$(r+5)(p-6) = 600$$

$$(r+5)\left(\frac{600}{r} - 6\right) = 600$$

$$(r+5)(600 = 6r) = 600$$

$$600r - 6r^2 + 3000 - 30r = 600r$$

$$r^2 + 5r - 500 = 0$$

$$(r25)(r-20) = 0$$

$$r = 20$$

(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)

$$T_6 = p + 5c$$
$$T_5 = p + 4d$$
$$p + 4d = p + 5c$$
$$4d = 5c$$
$$d = \frac{5}{4}c$$

(b)

$$p + 3d - (p + 3c) = 1\frac{1}{2}$$

$$3d - 3c = 1\frac{1}{2}$$

$$\frac{15}{4}c - 3c = 1\frac{1}{2}$$

$$\frac{3}{4}c = \frac{3}{2} \Rightarrow c = 2$$

$$d = 2\frac{1}{2}$$

(c)

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

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

<div align="right">(10 marks)</div>

23.   (a)

$$5 = k_1 t + k_2 t^2$$
$$80 = 2k_1 + 4k_2 \quad ....(i)$$
$$135 = 3k_1 + 9k_2 \quad ....(ii)$$

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

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)

$$560 = 30t5t^2$$
$$5t^2 + 30t - 560 = 0$$
$$t + 6 - 112 = 0$$
$$(t+14)(t-8) = 0$$
Time taken, $t = 8$ seconds

<div align="right">(10 marks)</div>

24.   (a)   (i)

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

450

(ii)

$$\angle RTS = 30^0 \ and \ \angle RPS = 50^0$$
$$\therefore \angle USP = 30^0 + 50^0 = 80^0$$

(iii)　　$\angle PQR = 180^0 - 50^0 = 130^0$

(b)　(i)

$$PT \times TR = TS^2$$
$$(7 + x)(7) = 9^2$$
$$7x = 81 - 49 = 32$$
$$x = \frac{32}{7} = 4.57$$

(ii)

$$\angle ORP = 40^0$$
$$\cos 40^0 = \frac{\frac{1}{2} \times 4.57}{r}$$
$$r = \frac{\frac{1}{2} \times 4.57}{Cos\ 40} = 2.98$$

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

　　　　　　　　　　　　　　　　　　2 marks

451

4.   Width of floor $= \sqrt{37.7^2 - 35.2^2}$

      $\therefore$ area of floor $= \sqrt{37.7^2 - 35.2} \times 35.2$

                      $= 475.2 \text{ m}^2$ 3 marks

5.

NO.	LOG
43.2	1.6355
0.015	+
	$\bar{2}.1861$
	$\bar{1}.8116$
	-
$\sqrt[3]{0.00679}$ $\bar{3}.8319 \div 3$	$\bar{1}.2773$
3.422	0.5343

6. $\angle CBG = 180^0 - 120^0 = 60^0$

      $\angle ECB = 90^0$

      $\angle BGC = 30^0$ 3 marks

7. $\dfrac{3\frac{1}{3} + \frac{6}{7} \times \frac{49}{9}}{\frac{44 - 35}{10}}$

      $= \dfrac{\frac{8}{9}}{\frac{9}{10}}$

      $= \dfrac{8 \times 10}{9} = 8\frac{8}{9}$ 3 marks
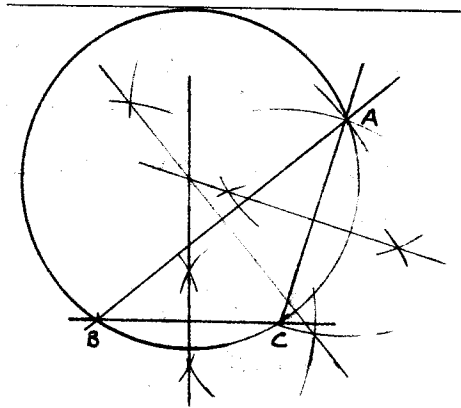
8.   Volume of water in m^3

          $= \dfrac{21000}{100} = 21 \text{ m}^3$

      Height of water

          $= \dfrac{21}{4 \times 3.5} = 1.5 \text{ m}$

                                                           3 marks

9.

Construction of ΔABC
Construction of ⊥ as bisectors
Construction of circle

<div align="right">3 marks</div>

10. $3x - 2 < 10 + x \leq 2 + 5x$
       $3x - 2 < 10 + x$
       $2x < 12$
       $x < 6$

       $10 + x \leq 2 + 5x$
       $-4x < -8$
       $-x < -2$
       $x \geq 2$

       $\therefore 2 \leq x < 6$

<div align="right">3 marks</div>

11.   Length of ⊥ a, $h = 12 \sin 36^0$
       $= 7.05$

       $\therefore$ area of trapezium

       $= \dfrac{20 + 8}{2} \times 7.05$

       $= 98.75 \text{ cm}^3$

<div align="right">4 marks</div>

12.   Ratio of increase: 1200:800
                          =   3:2

       Original price for a pair of trousers
       $\dfrac{t}{2700} = \dfrac{2}{3}$

       $t = \dfrac{2}{3} \times 2700 = 1800$

<div align="right">3 marks</div>

453

13. Shaded area

$$= \frac{150}{360} \times \pi \times 10.5^2 - \frac{1}{2} \times 10.5^2 \sin 150^0$$

$$= 144.3169125 - 27.5625$$
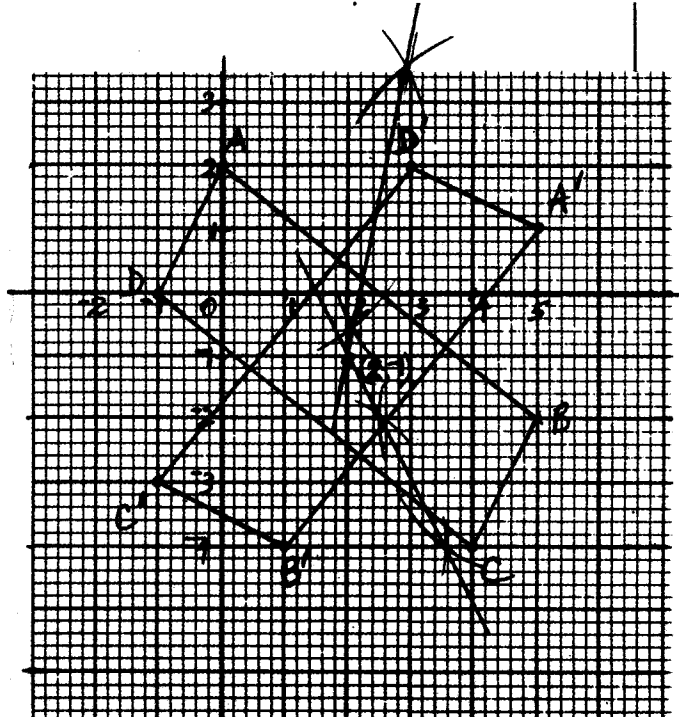
$$= 116.7544125 \approx 116.8 \, cm^2$$

4 marks

14. $25 = 5^2$; $30 = 2 \times 3 \times 5$; $35 = 5 \times 7$

LCM $= 2 \times 3 \times 5^2 \times 7$

Time $= \dfrac{1050}{60} = 17.5h$

4 marks

15.

a) Construction of at least 2 mediators
   Centre of rotation (2,-1)
b) Angle of rotation -90⁰

3 marks

16. Commission earned

$$\frac{2}{100} \times 30000 + \frac{3.5}{100} \times (84000 - 30000)$$

$$= 600 + 1890 = 2490$$

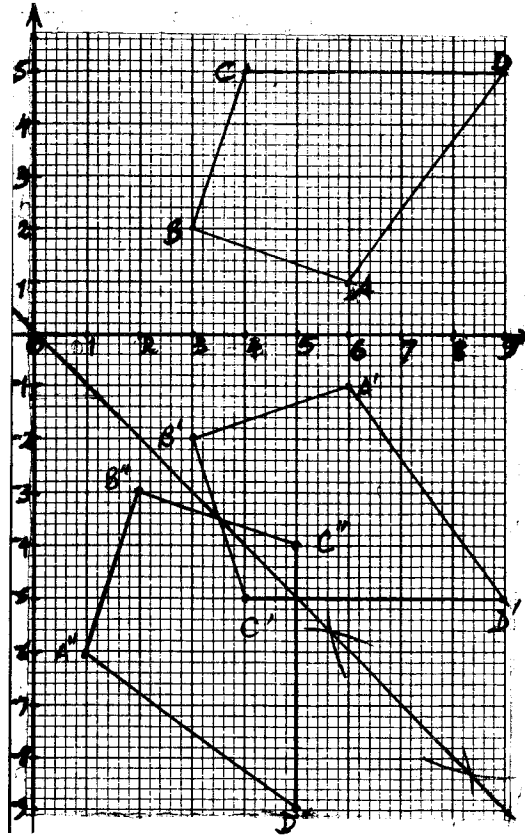Total earnings
12000 + 2490 = 14490

4 marks

17. a) 2400 x 120
         = 288000

454

b)   Amount left
     288000 − 13500
     In Tsh. = 153000 x 16.5
            = 2524500
     Amount in Tsh spent
     $\frac{40}{100} \times 2524500 = 1009800$

c)   Remaining amount in £
     $= \frac{60}{100} \times \frac{153000 \times 16.5}{1980}$

     = £ 765   10 marks

18.

a)   Drawing image A'B'C'D'

b)   (i) image A"B"C"D"
     (ii) mediator(s)

c)   (i) equation of line
          Gradient $\frac{^-5 - ^-3.5}{5 - 3.5} = ^-1$
          ∴ equation $y = ^-x$

455

(ii) I(1,0) → I'(0,⁻1); J(0,1) → J'(⁻1,0

∴ matrix of reflection in

$y = -x$ is $\begin{pmatrix} 0 & ^-1 \\ ^-1 & 0 \end{pmatrix}$

10 marks

19. a)

$(7x+5)(x+10)$

$= 7x^2 + 70x + 5x + 50$

$= 7x^2 + 75x + 50$

b)

$7x^2 + 75x + 50 = 600$

$7x^2 - 35x + 110x - 550 = 0$

$(7x + 110)(x - 5 = 0)$

$x = 5$

∴ *perimeter*

$= 2(7 \times 5 + 5) + 2(5 + 10)$

$= 80 + 30 = 110 m$

c) $\dfrac{110}{5} = 22$

10 marks

20. a) Cross sectional area

$= \pi \times (0.3^2 - 0.26^2)$

$= 0.070371675 \approx 0.07$

b) (i) External surface area

$\pi \times 2 \times 0.3 \times 6.5 + 2 \times 0.07$

$= 12.25221135 + 0.14$

$= 12.39$

(ii) Internal surface area

$= \pi \times 2 \times 0.26 \times 6.5$

$= 10.61858317 \approx 10.62$

(iii) Total surface area

$12.39 + 10.62$

$= 23.01 m^2$

10 marks

456

21.
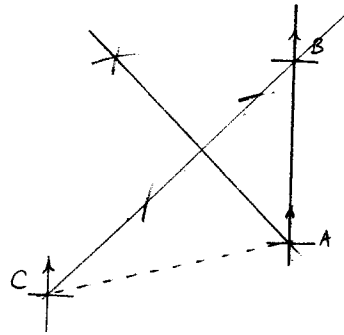
a) Location of B
Location of C

b) Distance of A from C
5.5
5.5 x 100 = 550 km

Bearing of A from C = 255^0

c) Shortest distance of A from BC
Drawing $\perp$ ar
Measuring 2.8 cm
Actual distance = 2.8 x 100 = **280 km**

10 marks

22. a) $64 \text{ m}^3 = 64 \times 1000000$
$= 64000000 \text{ cm}^3$

b) v.s.f. $= \dfrac{64000000}{512} = 125000$

d.s.f. $\sqrt[3]{12500} = 50$

A.s.f. $= 50^2 = 2500$

c) Amount of paint required
$=$ 2500 x 0.004 = 10

Cost   =   10 x 120 = 1200

10 marks

23. a) distance travelled:

$$\frac{1}{2} \times 10 \times 20 = 100\,m$$

b) average velocity:

distance: 10 x 25 + ½ x 25 x 20
=   250 + 250 = 500

457

$$\therefore \text{ velocity} \quad \frac{500}{45-20} = 20 \text{ m/s}$$

c) acceleration: $\dfrac{0-30}{60-45}$ 4

4   4   4   4 $= \dfrac{-30}{15} = {}^{-}2m/s^2$

24.
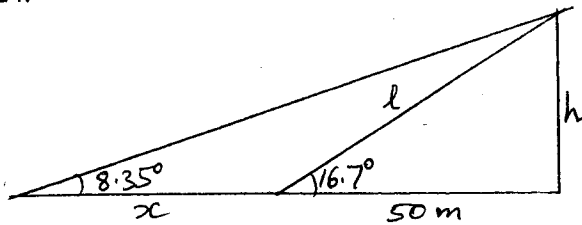
a) (i) $\dfrac{h}{50} = \tan 16.7^0$

$h = 50\tan 16.7^0 = 15.00071889$

$= 15.00m$

(ii) $\dfrac{50}{l} = \cos 16.7$

$l = \dfrac{5}{\cos 16.7} = 52.20173912$

$= 52.20\,m$

b) $\dfrac{15}{50+x} = \tan 8.35$

$50+x = \dfrac{15}{\tan 8.35}$

$50 + x = 102.1968412$

$x = 102.1968412 - 50$

$= 52.20 \text{ m}$

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. $= x^2 h$

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

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

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

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

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

(3 marks)

442

3. $\angle OCT = 36^0$ (Alt. $\angle s$ equal)

   $\angle OTC = 36^0$ (Base $\angle s$ of isosceles Δ)

   $\angle CTB = 90^0 - 36^0 = 54$

   <div align="right">(3 marks)</div>

4. Let ratio x to y be a:b

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

   $\Rightarrow 6a = 9b$

   $\therefore a : b = 9 : 6$

   $= 3 : 2$

   <div align="right">(2 marks)</div>

5. Let the width be x m

   Length $= 2x - 2$

   Area $= (2x - 2)x = 60$

   $x^2 - x - 30 = 0$

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

   $x = 6$

   $\therefore$ length $= 2 \times 6 - 2 = 10$ cm

   <div align="right">(3 marks)</div>

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

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

   <div align="right">(2 marks)</div>

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

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

   <div align="right">(3 marks)</div>

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

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

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

   <div align="right">(4 marks)</div>

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

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

                                                          (2 marks)

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

              x ordinate $= 3+2k$

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

           Or $3 + 2k = 0 \Rightarrow k = \dfrac{-3}{2}$

                                                           (4 marks)

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

     (b)   When t = 0, s = 0
               $\therefore$ C = 0
               $S = \dfrac{3}{2}t^2 - \dfrac{1}{3}t^3 = 0$
               $t^2 \left(\dfrac{3}{2} - \dfrac{1}{3}t \right) = 0$
               $t = 0 \quad Or \quad t = 4.5$
                      $t = 4.5$

                                                           (4 marks)

12.   (a) $(2-x)^5 = 2^5 - 5(2)^4 x + 10(2)^3 x^2$
                             $-10(2)^2 x^3 + 5(2)x^4 - x^5$
                        $= 32 - 80x + 80x^2 - 40x^3 + 10x^4 - x^5$

     (b) $(2 - o.2)^5 = 32 - 80(0.2) + 80(0.2)^2 - 40(0.2)^3$

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

                                                       (4 marks)

13.

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

<div align="right">(3 marks)</div>

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

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

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

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

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

<div align="right">(3 marks</div>

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

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

       $15 - 5x = 30x - 20$

       $x = 1$

<div align="right">(3 marks)</div>

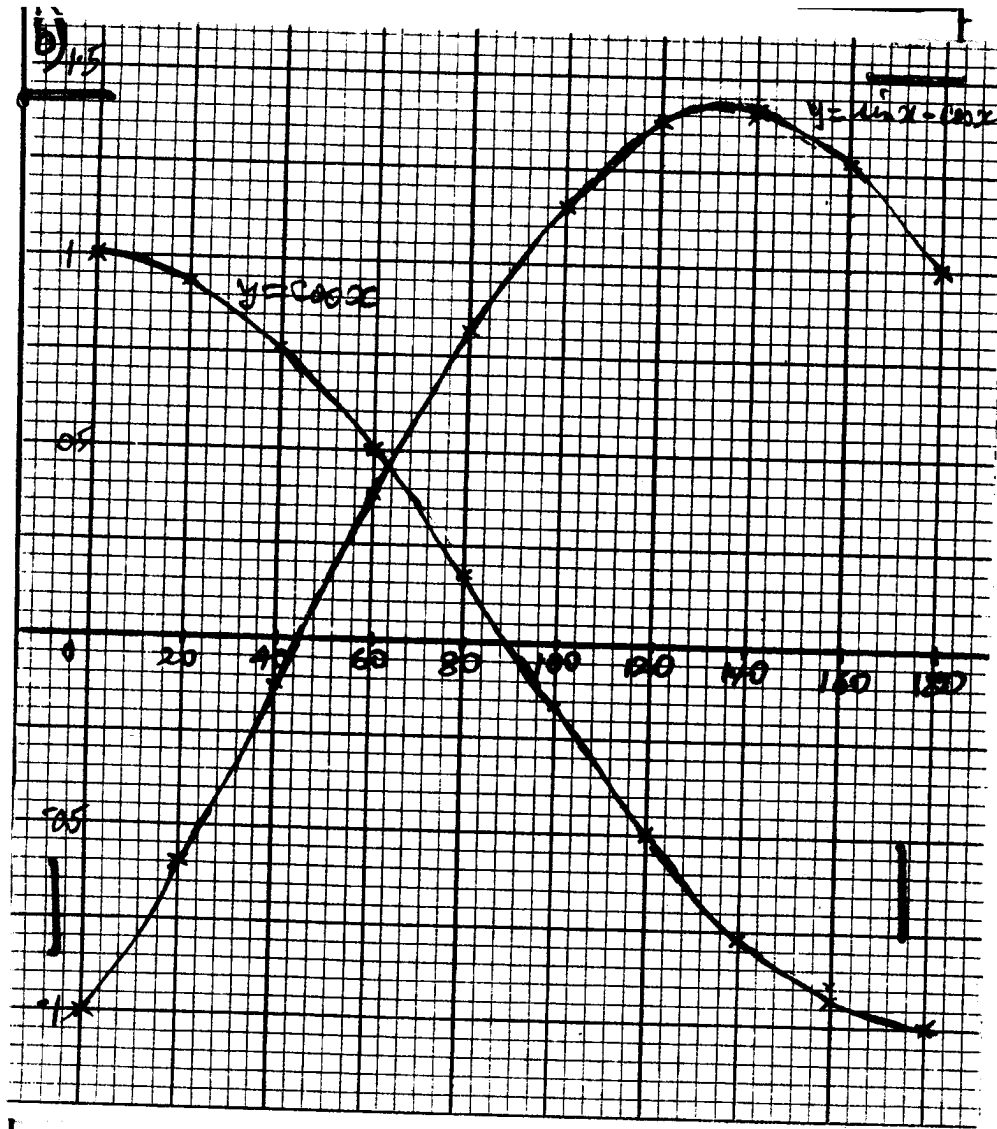16.   (a)   Coordinates of centre (1, -1)
               Radius: $r^2 = 1^2 + 3^3 = 10 \implies r = \sqrt{10}$

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

<div align="right">(4 marks)</div>

445

17.

x^0	0^0	20^0	40^0	60^0	80^0	100^0	120^0	140^0	160^0	180^0
$Cos\ x^0$					0.17		-0.5		-0.94	
$Sin\ x^0 - Cos\ x^0$			-0.13			1.15		1.41		

(c)   (i) $\sin x^0 - \cos x^0 = 1.2$

$x^0 = 104, 166$

(ii) $\cos x^0 = \frac{1}{2} \sin x^0$

$\Rightarrow \cos x^0 = \sin x^0 - Cos\ x^0 = 63^0$

(iii) $\cos 63^0 = 0.45$

(10 marks)

446

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)

                      $1-2n = 2-2n$

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

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

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

                      $3m = 1\dfrac{1}{4} \Rightarrow m = \dfrac{3}{2 \times 3} = \dfrac{1}{2}$

                      The ratio in which x divides AJ

                      $AX = nAJ = ¼AJ$
                      Ratio   1 : 3

                                                      (10 marks)

19. (a) (i)   Angle subtended (longitude)
                      $16 + 24 = 40^0$
                      Arc AB $= 60 \times 40 \times \cos 34^0$
                                    $= 1989.69 \approx 1990 \, nm$

             (ii)   Arc AC : latitude difference
                           $= 26 + 24 = 60$
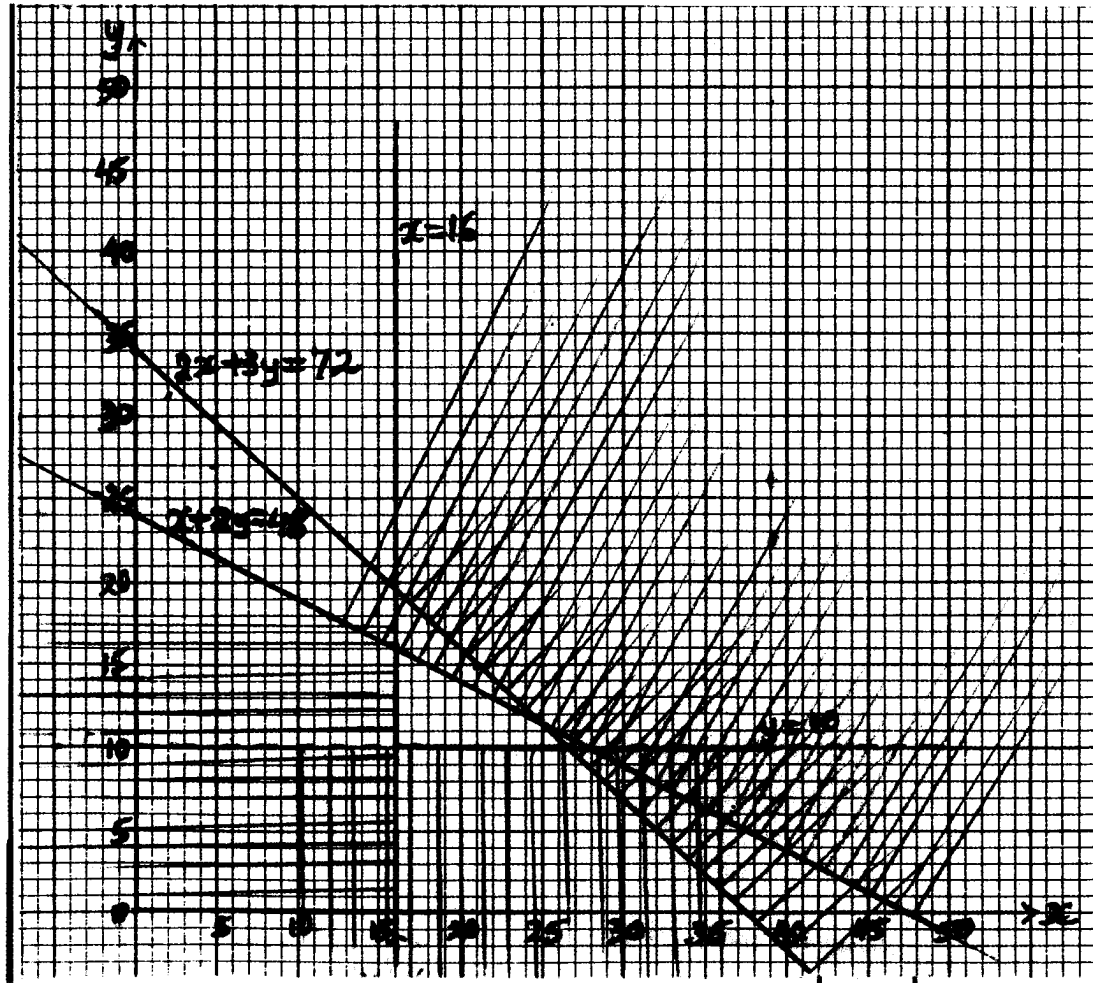 $\therefore$ Arc AC $= 60 \times 60 \, nm = 3600$

      (b) (i)   local time at B
                      $1330 + \dfrac{40}{15}h$
                      $1330 + 2h40 \min$
                      $1610h$

             (ii)   time taken to travel from A to B

                      $= \dfrac{1990}{40} = 49h45 \min.$

447

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

$$p = 40x \, 100y = 40 \times 16 + 100 \times 16$$
$$= 640 + 1600 = 2240$$

<div align="right">(10 marks)</div>

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

$$pr = 600 \Rightarrow p = \frac{600}{r}$$

$$(r+5)(p-6) = 600$$

$$(r+5)\left(\frac{600}{r} - 6\right) = 600$$

$$(r+5)(600 = 6r) = 600$$

$$600r - 6r^2 + 3000 - 30r = 600r$$

$$r^2 + 5r - 500 = 0$$

$$(r \, 25)(r - 20) = 0$$

$$r = 20$$

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

No. of empty spaces per row with 450 people seated

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

<div align="right">(10 marks)</div>

22. (a)

$$T_6 = p + 5c$$
$$T_5 = p + 4d$$
$$p + 4d = p + 5c$$
$$4d = 5c$$
$$d = \frac{5}{4}c$$

(b)

$$p + 3d - (p + 3c) = 1\frac{1}{2}$$

$$3d - 3c = 1\frac{1}{2}$$

$$\frac{15}{4}c - 3c = 1\frac{1}{2}$$

$$\frac{3}{4}c = \frac{3}{2} \Rightarrow c = 2$$

$$d = 2\frac{1}{2}$$

<div align="center">449</div>

(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)

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

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

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)

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

(10 marks)

24.   (a)   (i)

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

450

(ii)

$$\angle RTS = 30^0 \ and \ \angle RPS = 50^0$$

$$\therefore \angle USP = 30^0 + 50^0 = 80^0$$

(iii) $$\angle PQR = 180^0 - 50^0 = 130^0$$

(b)   (i)

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

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

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

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

(ii)

$$\angle ORP = 40^0$$

$$\cos 40^0 = \frac{\frac{1}{2} \times 4.57}{r}$$

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

(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

451