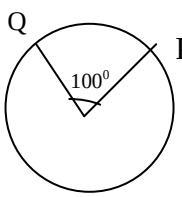
Longitudes and latitudes

1	∠ difference  $40 + 60 = 100^0$ Area $= \frac{100}{360} \times \frac{22}{7} \times (0.2\cos 60)^2$ $= \frac{55}{63} \times 0.01$ $= 0.008730$ $(87.30 cm^2)$	B_1 M_1 A_1	Angle difference
		3	
2	a) i) 480-1015' = 46045' B(46045'N,370E) ii) Diff in longitude $\Rightarrow 37 + 23 = 60^0$ $D = \frac{60}{360} \times 2 \times \frac{22}{7} \times 6370 \cos 46.75^0 = 4{,}572.45 km$ b) i) $\frac{60 \times 4}{60} = 4hrs$ difference $\therefore$ Time at C $= 7.00 - 4hrs$ = 9.00p.m ii) Time taken $= \frac{4572.45}{840} = 5.44hrs$ Arrival at c $= 9.00 + 5hrs 26 \min s$ = 2.26a.m	M1 A1 M1 M1 A1 M1 A1 M1 M1 A1	Subtraction ✓position Addition Allow 4,572km Or (1426hrs)
		10	
3.	Angle difference btw longitudes (41+3) = 440 Dist = 60 x angle difference x cos latitude 1370 = 60 x 44 cos P Cos P = $\frac{1370}{60 \times 44}$ Cos-1 o.51894 = 58.740 58.740	 M1 M1 A1	 Subst Cos P the subject
		03	
4.	a = 400 E	B1	

	b = 600 N	B1	
	c = 200 W	B1	
	(b)		
	R (600N, 400E)		
	P (300N, 200W)		
	Q (300N, 400E)		
	S (600N, 200W)		
	PQR PQ = 600 x 60 cos 300		
	= 3600x		
	= 3117.69 ✓	M1	✓values of PQ and
	QR = 30 x 60 = 1800nm ✓		QR
	Total distance = 1800 + 3117.69	A1	
	= 4917.69nm		
	PSR PS = 30 x 60 = 1800nm	M1	
	SR = 60 x 60 cos 60 = 1800 =	A1	✓value of PS and
	Total distance 1800 + 1800 = 3600 ✓		SR
	(c) PQR speed 400nm/hr	B1	
	Time = 4917.69 = 12.294 hrs		
	400		
	Along PSR	B1	
	Time = 3600 = 12 hrs		
	300	B1	
	2nd pilot by 0.294hrs or 18 min		
		10	

1. *(70 – 25 x 60 = 2700*
2700 Cos 47= 2700 x 0.68 = 1841.4nm

2. *(a) $\frac{22}{7}$ x 6370 x 2 x $\frac{\alpha}{360}$ = 1600*
$\alpha = 14.4^o$
Position (4.4^oN, 60^oE)
(b) 72 x 60 cos 4.4^o
= 4307nm
(c) $T = \frac{D}{S} = \frac{4307 \times 1.853}{800}$
= 9.976 hrs
(d) Difference in longitude = 72^o
15^o – 1hr
$\therefore 72^o = \frac{72}{15}$ = 4.8hrs = 4hrs 48mins behind
1300hrs
- 448

8.12a.m

3. *a) 800 x + 1600 y ≥ 8000*

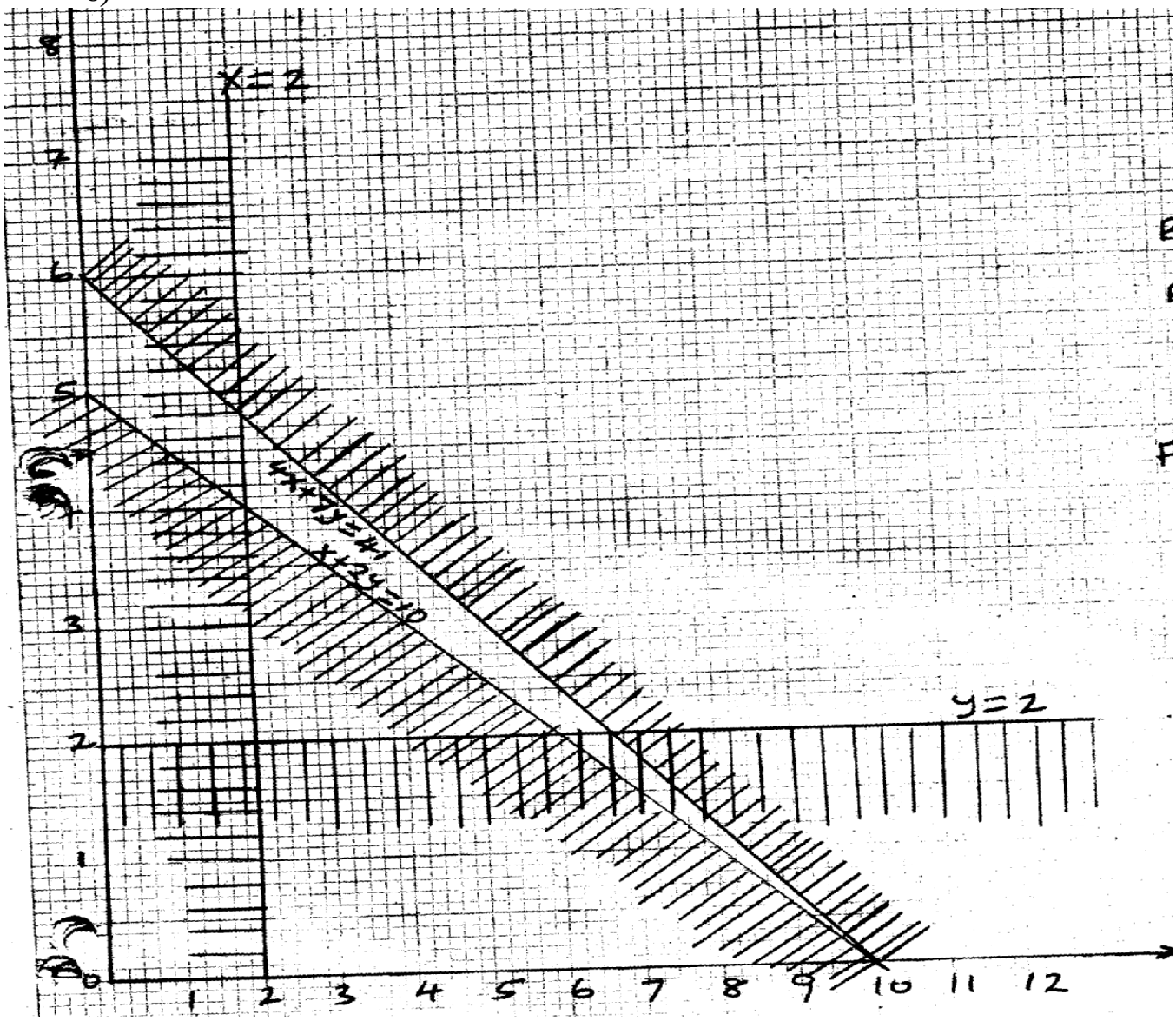
x + 2y ≥ 10

4x + 7y ≤ 41

x ≥ 2

y ≥ 2

b)



c) For type A = 3 and B = 4

No. of operators = (3x4) + (4x7)

4. *a) $^{180}/_{300}$ x 2 x 22/7 x 6370 cos 48 = 13,396Km*

b) Km = $\frac{(180 - 96)}{360}$ x 2 x $^{22}/_{7}$ x 6370

= $^{84}/_{360}$ x 2 x $^{22}/_{7}$ x 6370 = 9342.7 km

Time = $\frac{9342}{280}$ = 33.36 km/hr

c) $\theta = 180°$

time = $\frac{(4 \times 180)}{60}$ = 12 hrs

(14:15 – 12:00) = 2:15a.m

d) $\frac{600}{60}$ *Nm*

$60°$

$Q = (12N, 30W)$

5. *Long Difference = 24-12*

$= 12^o$

$12 \times 60 \cos 34^o = 596.9nm$

$S = \frac{\text{“5.96”nm}}{1.5}$

$= 397.9knots$

6. *(i)* $AB = \frac{80}{360} \times 2 \times 3.142 \times 25$

$\cap = \frac{4 \times 25}{9} \times 3.142$

$= \frac{314.2}{9}\ cm$

$= 34.9111\ cm.$

(ii) $\frac{\theta}{360} \times 2 \times 3.142 \times 25\cos 50^o = \frac{314.2}{9}$

$\theta = \frac{\frac{314.2}{9} \times 360}{50 \times 3.142 \times \cos 50}$

$= 93.35^o$

Longitude of BC $(93.35^o - 90^o)E$

$= 03.35^0E.$

(iii) $\frac{\theta}{360} \times 3.142 \times 50 = \frac{314.2}{9}$

$\theta = \frac{\frac{314.2}{9} \times 360}{3.142 \times 50}$

$= 80^o$

Latitude of B $(80^o - 50)\ S$

$= 30^oS$

Position of B $\Rightarrow (30^oS, 03.35^oE$

7. $2133.6 = \frac{x}{360} \times 2 \times \frac{22}{7} \times 6380 \cos 70^o$

$\propto = \frac{21.33 \times 6 \times 360 \times 7}{44 \times 6380 \times \cos 70^o}$

$\propto + 15^o = 56^o$

$= 56 - 15 = 41^oN$

$\therefore$*Location of B is* $B(70^oS, 41^oN$

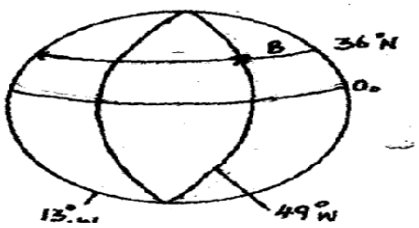
8. *(a) Longitudinal diff* $= 180^o$

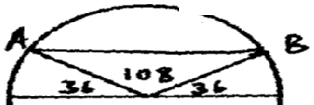
(b) (i) $\frac{180}{360} \times 2 \times \frac{22}{7} \times 6370 \times \cos 360o$

$= 16196.52m$

(ii) $\frac{180}{360} \times 2 \times \frac{22}{7} \times 6370$

$= 12012km$





(c) $^{\theta}/_{360}$ x 2x $^{22}/_{7}$ x 6370 cos 36= 840

= 9.3353^{o}

= position C = 131-9.3^{o}W

C(36^{o} N, 121.7^{o}W)

9. a) PQ = $^{120}/_{360}\pi$ x 6370 x 2

= $^{240}/_{360}\pi$ x $^{22}/_{7}$x 6370 = 13,346.6

b) 2PR cos 60 °

PR = $^{100}/_{360}$x2π x 6370 cos 60

= $^{200}/_{360}$x$^{22}/_{7}$ x 6370 cos 60 = 5561.1km

c) PN = $^{30}/_{360}$x2 x $^{22}/_{7}$ x 6370

= 3336.67 km

10. (a) (i) 60 (z -50) = 1200

Z = 20

Z = 70^{o}S

(ii) xy = 48 x 2 x 6370 cos 50

360 = 3431.629km

(b) (i) XZ = $\frac{3431.627}{1.853}$ + 1200

= 3051.9km

Time = $\frac{3051.9}{400}$ = 7.6hrs

(b) (ii) tie = 7.36 + 4.28 = 12.04

11. a)A – B = 45 + 35 = 800 Lat. Diff

= 80 X 60 = 4800nm

B – C = 15 + 45 = 60 0 long. Diff

= (60 X 60 X cos 45

= 3600 X 0.7071 = 2545.56nm

Total distance = (4800 + 2525.56)nm

= 7345.56nm

≈7346nm (4.s.f)

b) $\frac{\cancel{80}}{\cancel{360}}$ X 2 X $\frac{22}{\cancel{7}}$ X $\cancel{6370}$ 910

= $\frac{88 \times 910}{9}$

= 8897.78 km

≈8898km (to nearest km)

c) B- C = $\frac{\cancel{60}}{\cancel{360}}$ X 2 X $\frac{22}{\cancel{7}}$ X $\cancel{6370}$ X cos 45^{0}

= $\frac{22 \times 910 \times 0.7071}{\cancel{6}\ 3}$

= 471.8.7 km

A – C in Km = (8898 + 4718.70

=13616.7 KM

Time taken = 13616.7 / 840 = 16.21 hours

= 16 hrs 13min

Arrival time = 08.15

+ 16.13

24.28

= 12.28 am followinmorning