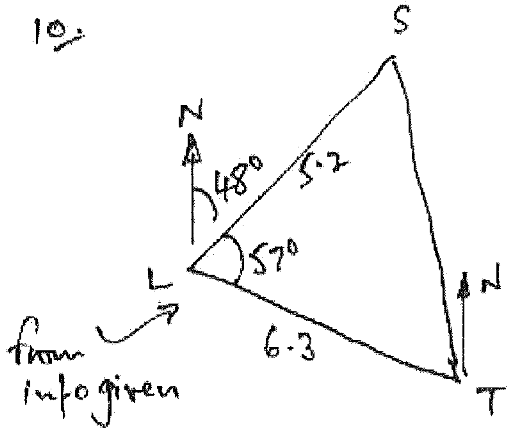
C2 June '06 SECT. B

10.



(i)

part (A)

using Cos. Rule: $ST = \sqrt{(5.2^2 + 6.3^2 - 2 \times 5.2 \times 6.3 \times \cos 57^\circ)}$

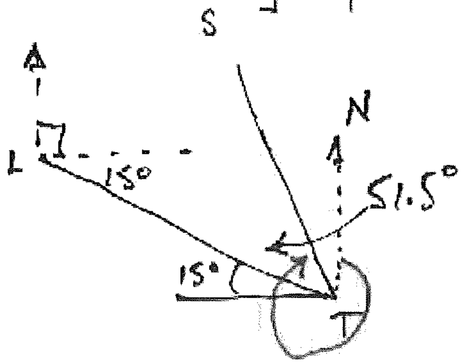
$= 5.571826489 \quad = \underline{\underline{5.57 \text{ km}}} \ (2\text{ s.f.})$

(B) bearing of S from T → find $\angle STL$

$$\frac{\sin S\hat{T}L}{5.2} = \frac{\sin 57^\circ}{5.571826489} \quad (\text{from pt (A)})$$

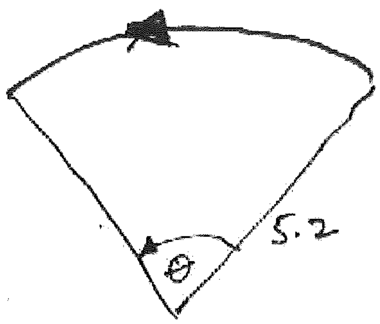
$\sin S\hat{T}L = 0.7827032952 \qquad \therefore S\hat{T}L = 51.5^\circ(087573)$

∴ bearing of S from T



$270^\circ + 15^\circ + 51.5^\circ \approx \underline{\underline{337^\circ}}$ (to nearest degree)

10 (ii)



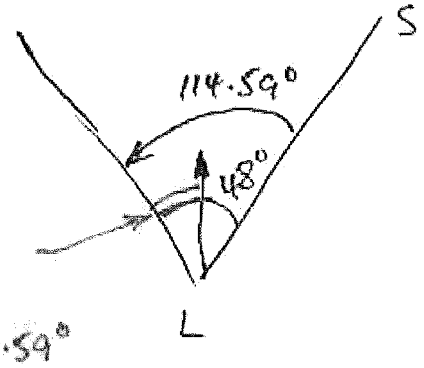
travel at 24 km h^{-1} for 26 mins

$\therefore$ Arc length

$\frac{26}{60} \times 24 = 10.4 \text{ km}$

$10.4 = r\theta$ (where $r = 5.2$) $\therefore$ $\theta = \frac{10.4}{5.2} = 2$ rads.

$2 \text{ rads} = \frac{360°}{\pi} = \underline{114.59°}$ $\left\{ \text{as } 360° = 2\pi \text{ rads}, \ \frac{360°}{\pi} = 2 \text{ rads} \right\}$.



$114.59 - 48 = 66.59°$

$\therefore$ Bearing of ship from L

$360 - 66.59 \approx \underline{\underline{293°}}$ (to nearest degree)

No. 11 $\quad y = x^3 - 3x^2 + 1$

$$\frac{dy}{dx} = 3x^2 - 6x = 3x(x-2) \quad \therefore \frac{dy}{dx} = 0 \text{ when } x = 0, 2$$

$$\frac{d^2y}{dx^2} = 6x - 6 = 6(x-1) \qquad \frac{d^2y}{dx^2} = 0 \text{ when } x = 1$$

[pt. of inflexion when $x=1$]

when $x=0$ $\quad \frac{d^2y}{dx^2} = -6 \quad \frac{d^2y}{dx^2} < 0 \rightarrow$ MAXIMUM.

$x=2$ $\quad \frac{d^2y}{dx^2} = 6 \quad \frac{d^2y}{dx^2} > 0 \rightarrow$ MINIMUM

when $x=0$ $\quad x^3 - 3x^2 + 1 = 1 \Rightarrow$ MAX at $(0,1)$

$x=2$ $\quad y = -3 \rightarrow$ MIN at $(2,-3)$

at $x=1$ $\quad \frac{dy}{dx} = 3(-1)^2 - 6(-1) = 9$

$x=3$ $\quad \frac{dy}{dx} = 3(3)^2 - 6(3) = 27 - 18 = 9.$ (gradient of tangent)

$y = (3)^3 - 3(3)^2 + 1 = 1 \Rightarrow (3, 1)$

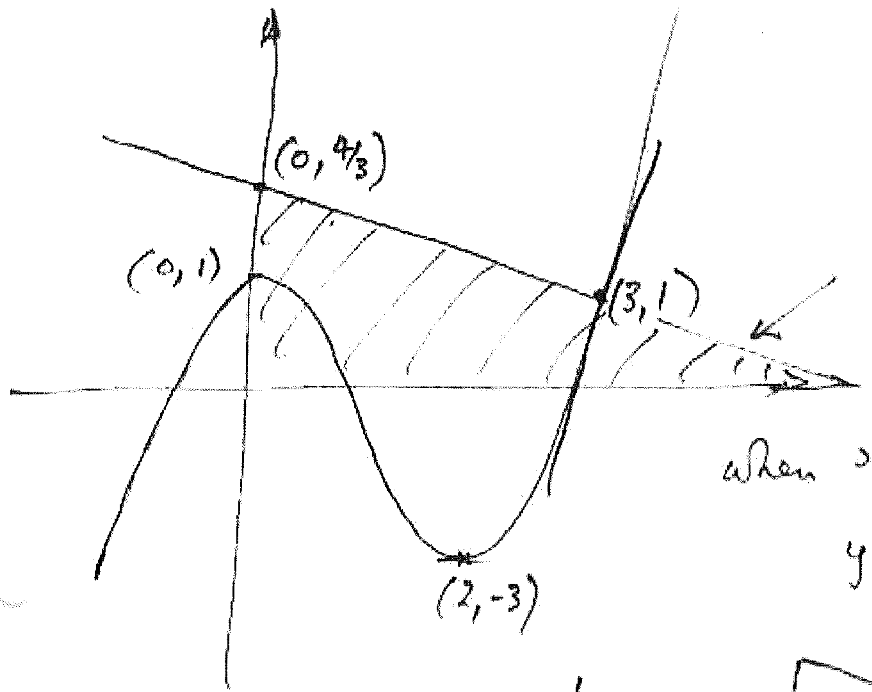
gradient of normal thro' $(3,1) = -1/9$

using $y = mx + c \rightarrow 1 = -\frac{1}{9} \times 3 + c \quad \therefore c = 4/3$

Eqn of Normal $\quad y = -\frac{1}{9}x + \frac{4}{3}$

(re-arranging gives $\Rightarrow$ $\quad \underline{\underline{x + 9y = 12}}$

No. 11 (contd.)

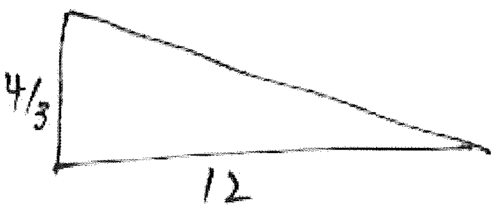


$x + 9y = 12$

when $x = 0 \quad y = 4/3$

$y = 0 \quad x = 12$

hence



Area $= \frac{1}{2} \times 12 \times \frac{4}{3} = \underline{\underline{8 \text{ units}^2}}$ as req'd.

No.12

(i) $P = a \times 10^{bt}$

$\therefore \log_{10} P = \log_{10}(a \times 10^{bt})$

$= \log_{10} a + \log_{10} 10^{bt}$

$= \log_{10} a + bt \log_{10} 10$ (as $\log_{10} 10 = 1$)

$\therefore \log_{10} P = bt + \log_{10} a$ (comparing to $y = mx + c$)

$\log_{10} P = bt + \log_{10} a$

graph of $\log_{10} P$ against t

gives a gradient of b

and intercept $\log_{10} a$

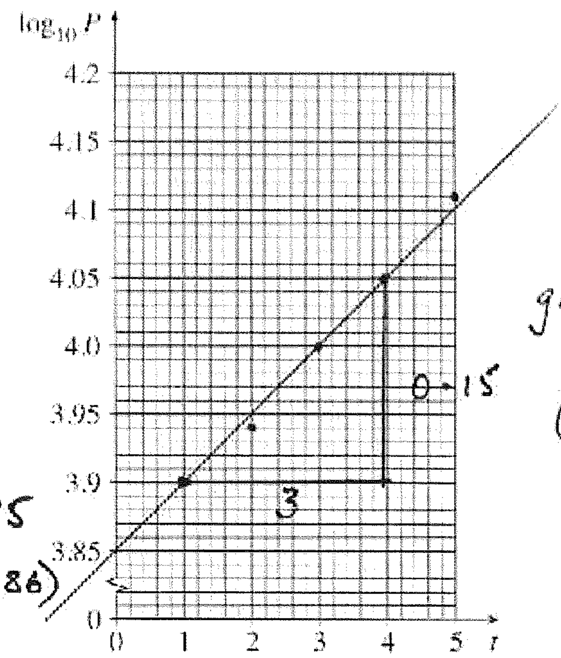
(ii) See copy of INSERT (next page)

12 **(i)** on previous page . . .

(ii)

Year	2001	2002	2003	2004	2005
t	1	2	3	4	5
P	7900	8800	10000	11 300	12 800
$\log_{10} P$	3.90	3.94	4	4.05	4.11

(given to 2 d.p)



gradient $\frac{0.15}{3} = 0.05$

(accept 0.04 to 0.06)

intercept 3.85

(accept 3.83 to 3.86)

(iii) $10^{3.85} \approx 7079$ $(= a)$ gradient $b = 0.05$

$\therefore$ eqn $P = 7079 \times 10^{0.05t}$

(iv) for 2008, $t = 8$

$\therefore$ $P = 7079 \times 10^{0.05 \times 8} \approx 17780$

(accept 17000 to 18500)