1. (a) $\frac{4-5x}{2} > \frac{4x+1}{4}$

$\frac{4-5x}{2} - \frac{4x+1}{4} > 0$

$\frac{2(4-5x) - (4x+1)}{4} > 0$

$8-10x-4x-1 > 0$

$-14x+7 > 0$

$-14x > -7$

$x < \frac{1}{2}$ #

(b) (i) $W = \frac{1}{2}m(v^2-u^2)$

$= \frac{1}{2}(3)[10^2-4^2]$

$= 126$ #

(ii) $W = \frac{1}{2}m(v^2-u^2)$

$2W = m(v^2-u^2)$

$v^2-u^2 = \frac{2W}{m}$

$u^2 = v^2 - \frac{2W}{m}$

$u = \pm\sqrt{v^2-\frac{2W}{m}}$ #

1(c) $\dfrac{8xy+2x^2}{x^2-16y^2} = \dfrac{2x(4y+x)}{(x)^2-(4y)^2}$

$= \dfrac{2x(4y+x)}{(x+4y)(x-4y)}$

$= \dfrac{2x}{x-4y}$ #

(d) $\dfrac{4}{x+3} + \dfrac{3}{x-2} = 1$

$\dfrac{4(x-2)+3(x+3)}{(x+3)(x-2)} = \dfrac{1}{1}$

$4x-8+3x+9 = x^2-2x+3x-6$

$x^2-6x-7=0$

$(x+1)(x-7)=0$

$x=-1$ or 7 #

2(a) total amount of electricity consumed

$= 41199.8 \times 10^9$ wh

$= 41199.8 \times 10^6 \times 10^3$ wh

$= 4.1199 \times 10^{10}$ kwh

$= 4.12 \times 10^{10}$ kwh (3 s.f) #

(b) % of total amount that was consumed by manufacturing

$= \dfrac{16692.0}{41199.8} \times 100\%$

$= 40.51$

$= 40.5\%$ (3 s.f) #

2(c) Average amount of domestic electricity consumed per person

$= \dfrac{7304.5 \times 10^9}{5.077 \times 10^6}$

$= 1438.74 \times 10^3$

$= 1439$ kwh (nearest kwh) #

(d) Percentage increase in electricity consumption by other industries from 2009 to 2010

$= \dfrac{17202.3 - 13628.0}{13628.0} \times 100\%$

$= 26.227\%$

$\approx 26.2\%$ (3 s.f)

(e) Domestic electricity consumption in 2000

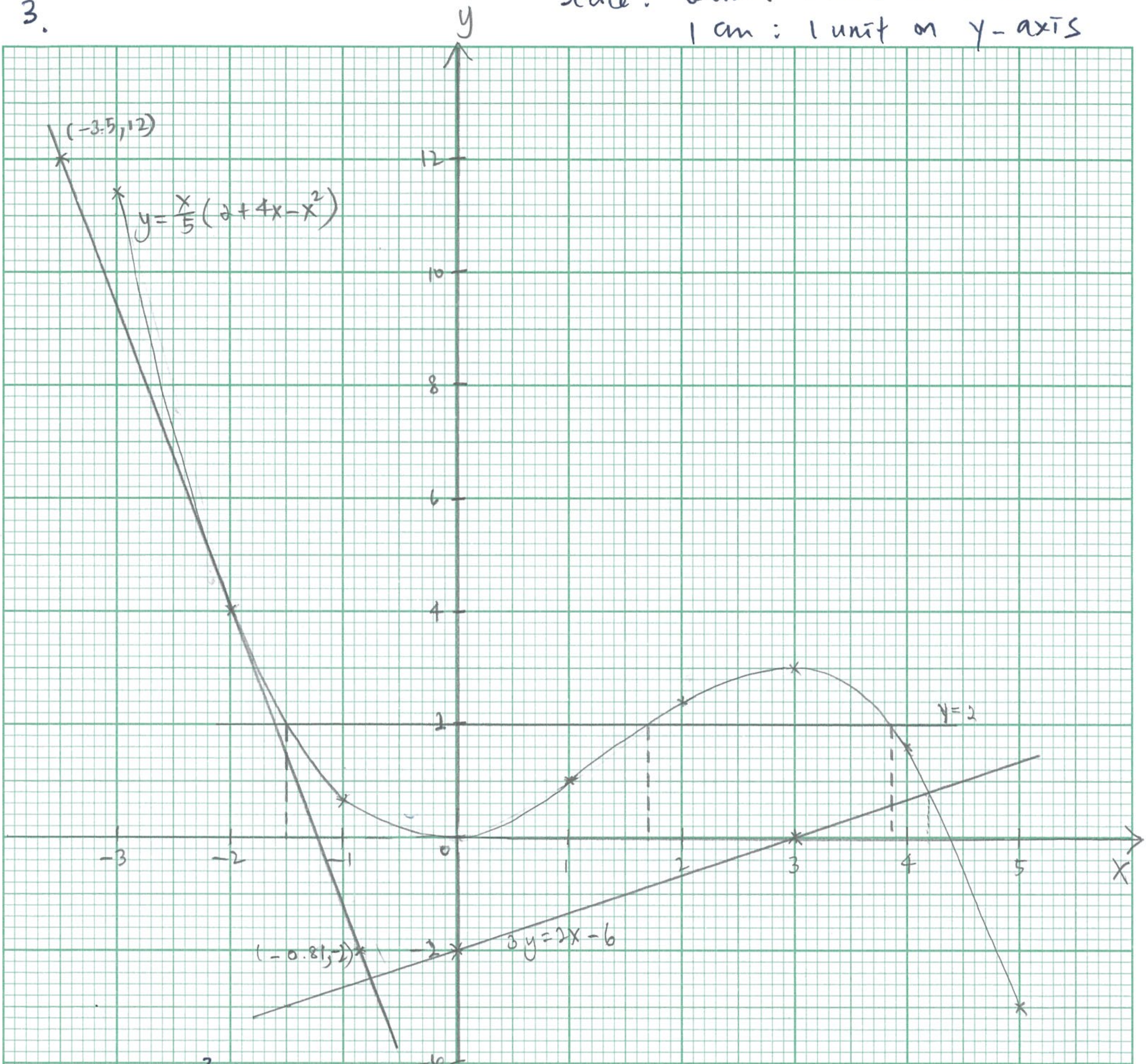
$= \dfrac{7304.5}{127.6} \times 100$

$= 5724.5$ GWh

≈ 5725 GWh (nearest GWh) #

3.

Scale : 2 cm : 1 unit on x-axis
1 cm : 1 unit on y-axis



(a) $p = -\frac{3}{5}\left[2 + 4(-3) - (-3)^2\right]$

$= 11.4$ ※

(c) $\frac{x}{5}(2 + 4x - x^2) = 2$

$y = 2$

$\therefore x = -1.50,\ 1.70$ and 3.86 ※

(d) Gradient at $(-2, 4) = \frac{12 - (-2)}{-3.5 - (-0.81)} = -5.20$ (3 s.f) ※

(e) (ii) Coordinate $= (4.2, 0.8)$ ※

4. (a) $\hat{ABF} = 180^\circ - 97^\circ$
$= 83^\circ$ (int. ∡s) #

(b) $\hat{BCF} = \hat{EDF}$ (alt. ∡s)
$\hat{BFC} = \hat{EFD}$ (opp. ∡s)

∴ ΔBCF & ΔEDF are similar #

(c) ΔEAB

(d) (i) Given AD : DE = 3 : 2
⇒ DF : AB = 2 : 5
⇒ AB : CF = 5 : 3 #

(ii) $\frac{\Delta EDF}{\Delta EAB} = \left(\frac{2}{5}\right)^2$
$= \frac{4}{25}$

$\frac{\Delta EDF}{\Delta BCF} = \left(\frac{2}{3}\right)^2$
$= \frac{4}{9}$

∴ $\frac{\text{Area of } \Delta EDF}{\text{Area of figure ABCFE}} = \frac{4}{3}$

$\frac{9.72}{\text{Area of figure ABCFE}} = \frac{4}{34}$

Area figure ABCFE $= 82.62 \text{ cm}^2$ #

5(a) $\overrightarrow{OA} = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$, $\overrightarrow{OB} = \begin{pmatrix} -5 \\ -2 \end{pmatrix}$

(i) $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= \begin{pmatrix} -1 \\ -5 \end{pmatrix} + \begin{pmatrix} -5 \\ -2 \end{pmatrix}$

$= \begin{pmatrix} -6 \\ -7 \end{pmatrix}$ #

(ii) $|\overrightarrow{AB}| = \sqrt{(-6)^2 + (-7)^2}$

$= \sqrt{85}$

$= 9.219$

≈ 9.22 units (3 s.f) #

(iii) $\overrightarrow{BA} = 2\overrightarrow{AC}$

$\begin{pmatrix} 6 \\ 7 \end{pmatrix} = 2(\overrightarrow{OC} - \overrightarrow{OA})$

$\begin{pmatrix} 6 \\ 7 \end{pmatrix} = 2\overrightarrow{OC} - 2\overrightarrow{OA}$

$2\overrightarrow{OC} = \begin{pmatrix} 6 \\ 7 \end{pmatrix} + 2\begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$\overrightarrow{OC} = \frac{1}{2}\begin{pmatrix} 8 \\ 17 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ 8.5 \end{pmatrix}$

C(4, 8.5) #

5(b)(i) $\overrightarrow{OP} = \begin{pmatrix} 8 \\ -2 \end{pmatrix}$

$\overrightarrow{OQ} = \overrightarrow{OP} + \overrightarrow{PQ}$

$= \begin{pmatrix} 8 \\ -2 \end{pmatrix} + \begin{pmatrix} 4 \\ -3 \end{pmatrix}$

$= \begin{pmatrix} 12 \\ -5 \end{pmatrix}$

$Q(12, -5)$

Gradient of PQ $= \dfrac{-5+2}{12-8}$

$= \dfrac{-3}{4}$

Equation of PQ : $y = -\frac{3}{4}x + c$

sub $(8,-2)$, $-2 = -\frac{3}{4}(8) + c$

$c = 4$

$\therefore y = -\frac{3}{4}x + 4$ # —— ①

(ii) $2y - 4x = 19$ —— ②

Sub ① into ②,

$2\left(-\frac{3}{4}x + 4\right) - 4x = 19$

$-\frac{3}{2}x + 8 - 4x = 19$

$-5.5x = 11$

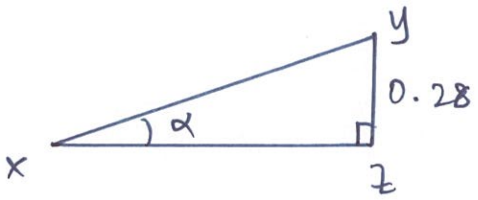
$x = -2$

Sub $x = -2$ into ①, $y = -\frac{3}{4}(-2) + 4$

$= 5.5$

$\therefore$ Point of intersection of PQ and RS $= (-2, 5.5)$ #

6 (a)



$XZ = 12(0.28)$
$= 3.36$ m

$\tan\alpha = \dfrac{0.28}{3.36}$
$= 0.08333$

$\alpha = \tan^{-1}(0.08333)$
$= 4.763$
$\approx 4.76^\circ$ (3 s.f.) (shown) #

(b) Volume of the completed ramp
= Base area × ht
$= \frac{1}{2}(0.28)(3.36)(1.95)$
$= 0.91728$ m^3

Mass of the completed ramp
$= 0.91728 \times 2300$
$= 2109.744$ kg #

(c) $XY^2 = XZ^2 + YZ^2$
$XY = \sqrt{3.36^2 + 0.28^2}$
$= 3.3716$ m

Total length of the handrail
$= 3.3716 + 2(0.3)$
$= 3.9716$
≈ 3.97 m (3 s.f.) #

7(a)(i) $B\hat{A}C = B\hat{D}C = 48°$ ($\angle$s from same segment) #

(ii) $A\hat{B}C = 90°$ (Δ in semicircle, $\because$ AC = diameter of circle)

$B\hat{C}A = 90° - B\hat{A}C$

$= 90° - 48°$

$= 42°$ (sum of $\angle$s in Δ) #

(iii) $A\hat{D}B = 180° - 90° - 48°$

$= 42°$ (opp $\angle$s of cyclic Quad)

$A\hat{D}E = \dfrac{42°}{2}$

$= 21°$ ($\because$ ED bisects $A\hat{D}B$)

$O\hat{A}D = A\hat{D}E$

$= 21°$ (ΔOAD is an isos. Δ)

$\therefore A\hat{O}D = 180° - 21° - 21°$

$= 138°$ (sum of $\angle$s in Δ) #

(iv) $A\hat{C}D = O\hat{D}C$

$= 21° + 48°$

$= 69°$ (ΔOCD is an isos. Δ)

$A\hat{F}B = D\hat{F}C$

$= 180° - 69° - 48°$

$= 63°$ (sum of $\angle$s in Δ) #

7 (b) (i) $20\theta + AD + BC + 50\theta = 235$

$70\theta + 30 + 30 = 235$

$70\theta = 175$

$\theta = 2.5$ rad #

(ii) Area of the mirror

$= \frac{1}{2}(50)^2(2.5) - \frac{1}{2}(20)^2(2.5)$

$= 2625\ cm^2$ #

8 (a) x min $\rightarrow$ 40 km

1 min $\rightarrow \frac{40}{x}$ km

60 min $\rightarrow \frac{2400}{x}$ km

1 hr $\rightarrow \frac{2400}{x}$ km

$\therefore$ Speed for the first 40 km $= \frac{2400}{x}$ km/h #

(b) $(x+15)$ min $\rightarrow$ 50 km

1 min $\rightarrow \frac{50}{x+15}$ km

60 min $\rightarrow \frac{3000}{x+15}$ km

1 hr $\rightarrow \frac{3000}{x+15}$ km

$\therefore$ Speed for the rest of the journey $= \frac{3000}{x+15}$ km/h

#

8(c) $\frac{2400}{x} - \frac{3000}{x+15} = 9$

$\frac{2400(x+15) - 3000x}{x(x+15)} = 9$

$2400x + 36000 - 3000x = 9x(x+15)$

$9x^2 + 135x + 600x - 36000 = 0$

$3x^2 + 245x - 12000 = 0$ (shown) #

(d) $3x^2 + 245x - 12000 = 0$

$a = 3,\ b = 245,\ c = -12000$

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

$= \frac{-245 \pm \sqrt{245^2 - 4(3)(-12000)}}{2(3)}$

$= \frac{-245 \pm \sqrt{204025}}{6}$

$= 34.448$ or -116.115

$\simeq 34.45$ or -116.12 (2.d.p) #

(e) Total time taken $= 34.448 + 34.448 + 15$

$= 83.896$ min

Average speed for whole journey $= 90 \div \frac{83.896}{60}$

$= 64.365$

$\simeq 64.4$ km/h (3 s.f) #

9. (a) (i) $\frac{\sin A\hat{B}C}{3.8} = \frac{\sin 78^\circ}{4.6}$

$\sin A\hat{B}C = \frac{3.8 \sin 78^\circ}{4.6}$

$A\hat{B}C = 53.904^\circ$

$\approx 53.9^\circ$ (1 d.p)

(ii) $B\hat{A}C = 180^\circ - 53.904^\circ - 78^\circ$

$= 48.095^\circ$

Area of the flower bed $= \frac{1}{2}(3.8)(4.6)\sin 48.095$

$= 6.5047$

$\approx 6.50\ m^2$ (3 s.f.) #

(b) (i) $M\hat{C}A = 90^\circ$ ($\because CM \perp AC$)

$AM^2 = AC^2 + CM^2$ (Pythagorus' Thm)

$AM = \sqrt{3.8^2 + 6.0^2}$

$= 7.102$

≈ 7.10 (2 d.p) (shown) #

(ii) $\sin M\hat{B}C = \frac{6.0}{6.95}$

$M\hat{B}C = 59.69^\circ$

$\approx 59.7^\circ$ (1 d.p)

$\therefore \angle$ of elevation of M from B $= 59.7^\circ$ #

9 (b) (iii) $\cos A\hat{M}B = \dfrac{AM^2 + MB^2 - AB^2}{2(AM)(MB)}$

$= \dfrac{7.102^2 + 6.95^2 - 4.6^2}{2(7.102)(6.95)}$

$\cos A\hat{M}B = 0.78588$

$A\hat{M}B = 38.197°$

$\approx 38.2°$ (1 d.p) #

10 (a) (i) Percentage of the males ran faster than 10km/h

$= \dfrac{15+32+30}{100} \times 100\%$

$= 77\%$ #

(ii) (a) Mean time for male $= \dfrac{15(35)+32(45)+30(55)+16(65)+7(7…}{100}$

$= 51.8$ min #

(b) Standard deviation for male

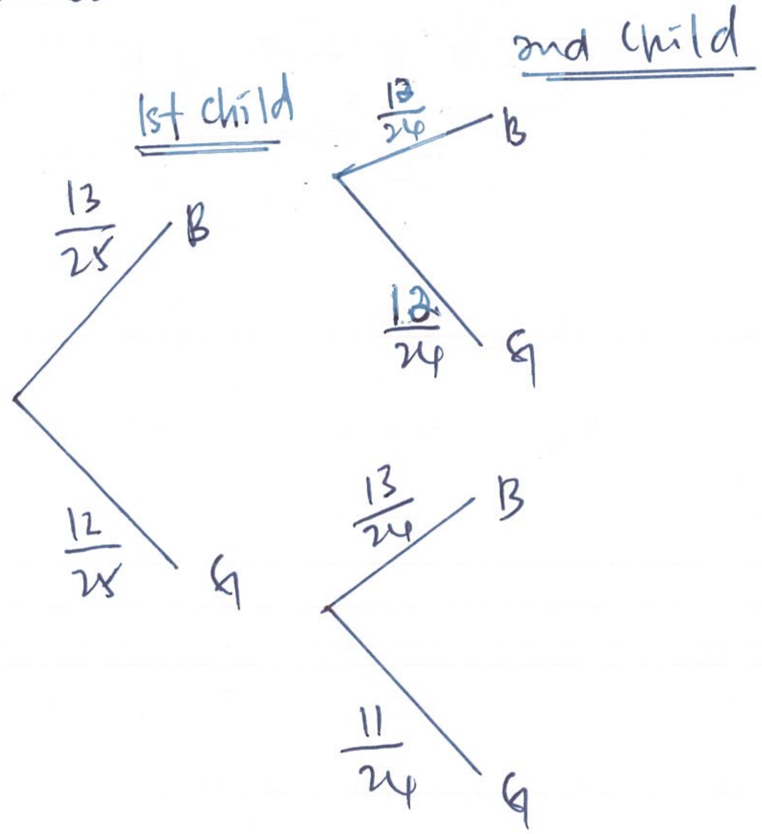
$= \sqrt{\dfrac{15(35)^2 + 32(45)^2 + 30(55)^2 + 16(65)^2 + 7(75)^2}{100} - 51.8^2}$

$= 11.214$

≈ 11.2 min (3 s.f) #

10 (a) (iii) In general, males complete the race faster than females because they have a lower mean time compared to the females.
However, there is a greater spread in the times taken by the males to complete the race compared to the female due to the larger standard deviation in the time taken by the males.

(b) (i)



(ii) (a) P(Two girls are selected) $= \frac{12}{25}\left(\frac{11}{24}\right)$

$= \frac{11}{50}$ #

(b) P(One boy and one girl are selected)

$= \frac{13}{25}\left(\frac{12}{24}\right) + \frac{12}{25}\left(\frac{13}{24}\right)$

$= \frac{13}{25}$ #