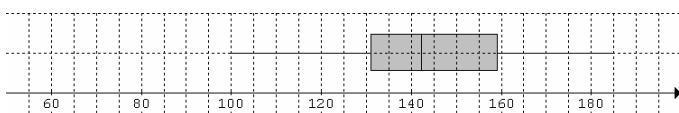


Core – Data analysis

Q1a The mean height ≈ 142 ,
95% are in the interval $142 \pm 2\sigma \approx 142 \pm 36$, $\therefore \sigma \approx 18$.

Q1b $z = -2$ corresponds to the height that is 2σ lower than the mean height, i.e. around 107.

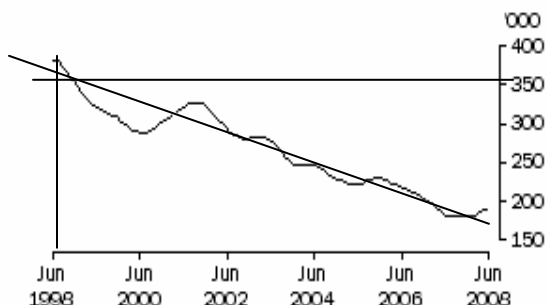
Q1c Median ≈ 142 , $Q_1 \approx 131$, $Q_3 \approx 159$, min ≈ 100 ,
max ≈ 185 .



Q2a $0 < \text{time} < 10$ or $0 \leq \text{time} \leq 10$.

Q2b $-20.5 \times 12 + 435 = 189$ thousands.

Q2c



Number of males looking for full-time work $= -20 \times \text{time} + 370$.

Q2d In June 2010, number of males looking for full-time work
 $= -20 \times 12 + 370 = 130$ thousands.

% of unemployed males $\approx \frac{130}{189} \times 100\% \approx 69\%$.

Q3a Non-linear upward trend. $r = 0.8883$.

Q3b

Log d	0.2553	0.3802	0.7634	0.7924	0.8195	0.8921
h (m)	2.0	2.9	3.6	4.0	4.9	4.0

0.9345	1.0934	1.2833	1.4014	1.5079	1.7126
4.5	6.4	7.5	9.3	7.4	9.7

$h = 5.4531 \times \log d + 0.1381$.

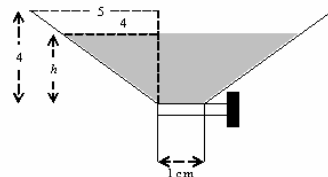
Q3c $r^2 = 0.9053$ of variability is explained by
 $h = 5.4531 \times \log d + 0.1381$.

Q3d When $d = 60$ cm, $h = 5.4531 \times \log 60 + 0.1381 = 9.8345$ m.

Module 2: Geometry and trigonometry

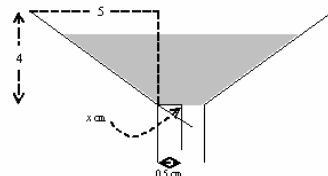
Q1a $r = 4.5$ cm, $A = \pi r^2 = 63.6$ cm²

Q1b



$$\frac{h}{4} = \frac{4}{5}, h = \frac{16}{5} = 3.2.$$

Q1c



$$\frac{x}{5} = \frac{4}{0.5}, \therefore x = 0.4. \text{ Volume of water}$$

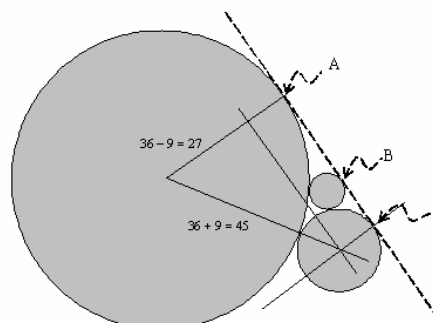
$$= \frac{1}{3} \pi (4.5)^2 (3.2 + 0.4) - \frac{1}{3} \pi (0.5)^2 (0.4) = 76.2 \text{ cm}^3. \text{ (Not 76.3)}$$

Q2a Side lengths are $a = 4.0 + 9.0 = 13$, $b = 9.0 + 36 = 45$ and
 $c = 36 + 4.0 = 40$. $s = \frac{1}{2}(a + b + c) = 49$.
 $A = \sqrt{s(s-a)(s-b)(s-c)} = 252$ m².

$$\text{Q2b } 45^2 = 13^2 + 40^2 - 2(13)(40)\cos\theta^\circ,$$

$$\theta^\circ = \cos^{-1}\left(\frac{13^2 + 40^2 - 45^2}{2(13)(40)}\right) \approx 104^\circ.$$

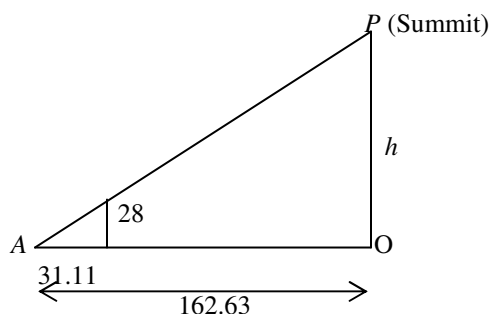
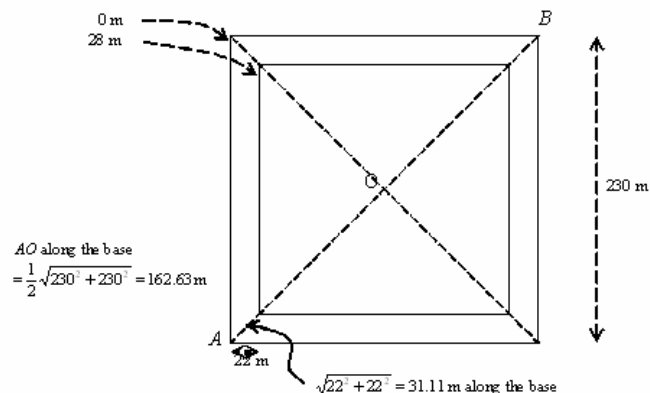
Q2c



$$\text{Distance } AC = \sqrt{45^2 - 27^2} = 36 \text{ m.}$$

Q2d Length scale factor $= \frac{1}{2}$, area scale factor $= \frac{1}{4}$,
 $\therefore \text{area} = \frac{1}{4} \times 252 = 63$ m².

Q3a



$$\frac{h}{28} = \frac{162.63}{31.11}, \quad h = 146.37,$$

$$\therefore AP = \sqrt{162.63^2 + 146.37^2} = 218.79.$$

Distance from A to B over the summit = $218.79 \times 2 = 437.6$ m.

$$\text{Q3b } \tan \theta = \frac{28}{31.11}, \quad \theta = \tan^{-1}\left(\frac{28}{31.11}\right) \approx 42^\circ.$$

$$\text{Q3c Volume of pyramid} = \frac{1}{3} \times 230 \times 230 \times 146.37 = 2580991 \text{ m}^3.$$

$$\text{Volume scale factor} = \frac{1}{2580991},$$

$$\therefore \text{length scale factor} = \sqrt[3]{\frac{1}{2580991}},$$

$$\therefore \text{area scale factor} = \left(\sqrt[3]{\frac{1}{2580991}}\right)^2 = 0.000053147$$

$$\text{Base area of the model} = 230 \times 230 \times 0.000053147 \approx 2.8 \text{ m}^2.$$

Module 3: Graphs and relations

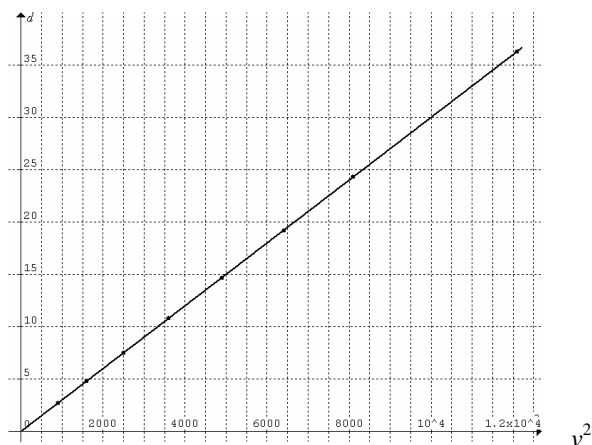
$$\text{Q1a Speed} = \text{slope of graph} = \frac{15}{2.5} = 6.0 \text{ km h}^{-1}.$$

$$\text{Q1b } t = 0 \text{ to } t = 4$$

$$\text{Q1c At } t = 1.5, \text{ distance apart} = 6.5 \text{ km.}$$

$$\text{Q1d At } t = 1.5, \text{ closest distance} = 8.0 - 6.5 = 1.5 \text{ km.}$$

Q2a



$$\text{Q2b } \text{m km}^{-2} \text{ h}^2$$

$$\text{Q2c Slope} = \frac{7.5}{2500} = 0.003, \quad d = 0.003 \times v^2.$$

$$\text{Q2d } d = 0.003 \times 100^2 = 30 \text{ m.}$$

$$\text{Q3a } 3x - y + 2 = 0 \quad \dots\dots (1)$$

$$5y + 2 = 4x \quad \dots\dots (2)$$

$$\text{From (1), } y = 3x + 2 \quad \dots\dots (3)$$

$$\text{Substitute (3) in (2), } 5(3x + 2) + 2 = 4x, \therefore x = -\frac{12}{11} \quad \dots\dots (4)$$

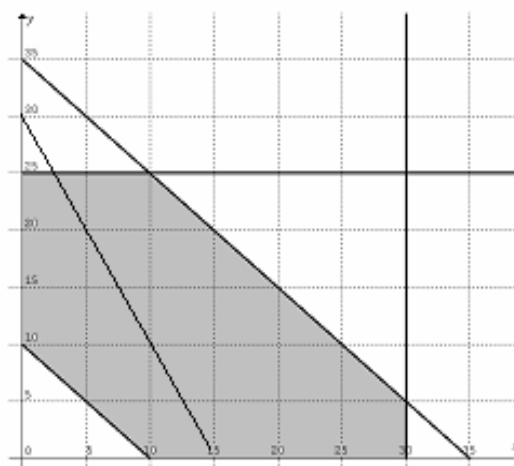
$$\text{Substitute (4) in (3), } y = 3\left(-\frac{12}{11}\right) + 2 = -\frac{14}{11}.$$

$$\text{Q3b } 3x - \frac{15}{4}y + 2 > 0 \text{ and } 5y + 2 \leq 4x.$$

$$\therefore 4x - 5y > -\frac{8}{3} \text{ and } 4x - 5y \geq 2.$$

$$\text{Hence } 4x - 5y \geq 2.$$

$$\text{Q4a } C = 5050 - 60x - 30y, \therefore y = -2x + c \text{ is the general equation for a graph of the cost function.}$$



$$\text{Q4b Minimum } \$C \text{ at } (30, 5).$$

$$C = 5050 - 60(30) - 30(5) = 3100.$$

Module 4: Business-related mathematics

Q1a Total depreciation = $18500 - 3300 = 15200$

$$15200 = \frac{18500 \times r \times 4}{100}, r = 20.54 \therefore \text{flat rate} = 20.54\% \text{ p.a.}$$

$$\text{Q1b } 3300 = 18500 \times \left(1 - \frac{r}{100}\right)^4, \left(1 - \frac{r}{100}\right)^4 = \frac{3300}{18500},$$

$$1 - \frac{r}{100} = \left(\frac{3300}{18500}\right)^{\frac{1}{4}} = 0.6499, r = 35.01.$$

$\therefore$ reducing balance depreciation rate = 35.01% p.a.

$$\text{Q1ci } V = 18500 - 3800t$$

$$\text{Q1cii } V = 18500 \times 0.6499^t$$

$$\text{Q2a End of first 6 months, } A = 3800 \left(1 + \frac{8.25}{100 \times 2}\right) = 3956.75.$$

$$\text{End of next 6 months, } A = 3956.75 \left(1 + \frac{8.75}{100 \times 2}\right) = 4129.86.$$

Q2b Let \$x be the value of \$4129.86 a year ago.

$$\left(1 + \frac{4.6}{100}\right)x = 4129.86, \therefore x = 3948.24.$$

$$\text{Real gain} = 3948.24 - 3800 = 148.24.$$

$$\text{Real \% gain} = \frac{148.24}{3800} \times 100 = 3.90.$$

Q3a 2006/07 average rate = 8.32% ,

2007/08 average rate = 9.29% .

Average increase = $9.29\% - 8.32\% = 0.97\%$.

$$\text{Q3b 2006/07 interest} = \frac{250000 \times 8.32 \times 1}{100} = 20800,$$

$$2007/08 \text{ interest} = \frac{250000 \times 9.29 \times 1}{100} = 23225.$$

$$\text{Total interest} = 20800 + 23225 = \$44025.$$

$$\text{Q3c } R = 1 + \frac{8.0}{100 \times 12} = 1.00666667.$$

$$A = PR^n - \frac{P(R^n - 1)}{R - 1}$$
$$= 250000 \times 1.00666667^{24} - \frac{1950(1.00666667^{24} - 1)}{0.00666667} = 242652.24$$

or by TVM Solver.

$$\text{Total interest} = 1950 \times 24 + 242652.24 - 250000 = 39452.24.$$

$$\text{Amount of interest less} = 44025 - 39452.24 \approx \$4573.$$

Please inform mathline@itute.com re conceptual, mathematical and/or typing errors