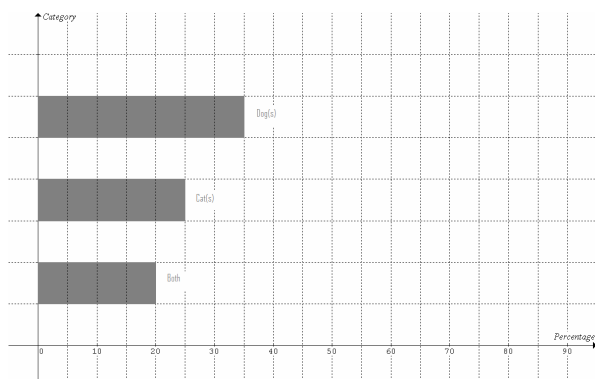


Core – Data analysis

Q1a



Q1b There are $25 + 20 = 45$ families with cat(s), $\therefore 55$ families without cat(s), i.e. 55%.

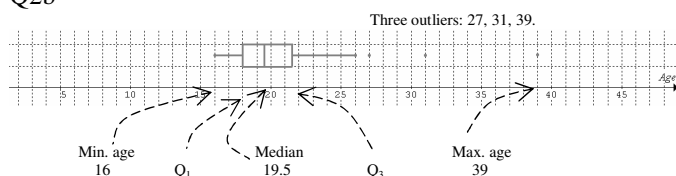
Q2a

Age	Frequency
16	1
17	2
18	6
19	1
20	3
21	2
22	1
26	1
27	1
31	1
39	1

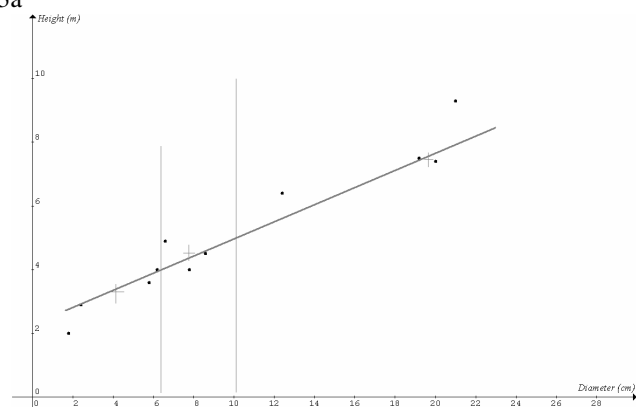
$Q_1 = 18$
 $Q_3 = 21.5$

$$IQR = 21.5 - 18 = 3.5.$$

Q2b



Q3a



Q3b The y-intercept ≈ 2.25 . Use the two outer median points to determine the gradient ≈ 0.26 .
 $\therefore H = 0.26d + 2.25$.

Q3c When $d = 12.50$, actual $H \approx 6.40$ from graph, predicted $H \approx 5.50$ from regression line.
Residual = actual value – predicted value = $6.40 - 5.50 = 0.90$ m.

Q4a $\log_{10} d$ transformation.

Q4b $r^2 = 0.97$ (By calculator).

Q4c $T = -11.66 \log_{10} d + 27.93$ (By calculator).

Alternative to Q4: $\frac{1}{d}$ transformation; $r^2 = 0.94$;

$$T = 6.41 \left(\frac{1}{d} \right) + 19.90.$$

Q5a 2007/08 average = $\frac{\text{sum}}{12} \approx 189.42$.

2008/09 average = $\frac{\text{sum}}{12} \approx 217.17$.

Seasonal index for November

$$= \frac{\frac{194}{189.42} + \frac{218}{217.17}}{2} = 1.0140.$$

Q5b Seasonally adjusted figure for November 2008

$$= \frac{218}{1.0140} \approx 215.$$

Module 2: Geometry and trigonometry

Q1a $\triangle OPQ$: Area = $\frac{1}{2}(40)(30) = 600$.

$\triangle OPR$: Area = $\frac{1}{2}(40)(30) = 600$.

$\triangle OQR$: Area = $\frac{1}{2}(40)(40) = 800$.

$\triangle PQR$: $PQ = PR = \sqrt{30^2 + 40^2} = 50$.

$QR = \sqrt{40^2 + 40^2} = 56.5685$.

$$s = \frac{1}{2}(50 + 50 + 56.5685) = 78.2843.$$

Area

$$= \sqrt{78.2843(78.2843 - 40)(78.2843 - 40)(78.2843 - 56.5685)}$$

$$= 1578.50.$$

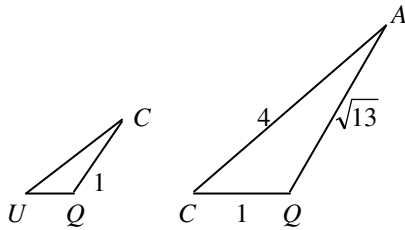
$$\text{Total surface area} = 600 + 600 + 800 + 1578.50 = 3578.50 \text{ cm}^2.$$

Q1b $\text{Volume} = \frac{1}{3}(\text{base area})(\text{height})$
 $= \frac{1}{3}(800)(30) = 8000 \text{ cm}^3$.

Q2a $\triangle CQU$, $\triangle AQC$.

Q2b The cosine rule:
 $AQ = \sqrt{1^2 + 4^2 - 2(1)(4)\cos 60^\circ} = \sqrt{13} \text{ m}$.

Q2ci



$\frac{UQ}{1} = \frac{1}{\sqrt{13}}$, $\therefore UQ = \frac{1}{\sqrt{13}} = \frac{\sqrt{13}}{13} \text{ m}$.

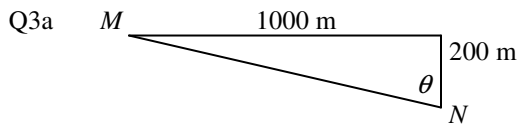
Q2cii $\frac{UC}{1} = \frac{4}{\sqrt{13}}$, $UC = \frac{4}{\sqrt{13}}$, $AS = UC = \frac{4}{\sqrt{13}} = \frac{4\sqrt{13}}{13} \text{ m}$.

Q2d $SU = \sqrt{13} - \frac{\sqrt{13}}{13} - \frac{4\sqrt{13}}{13} = \frac{8\sqrt{13}}{13} \text{ m}$.

Length ratio $AC : SU = 4 : \frac{8\sqrt{13}}{13} = 1 : \frac{2\sqrt{13}}{13}$.

Area ratio $\triangle ABC : \triangle STU = 1^2 : \left(\frac{2\sqrt{13}}{13}\right)^2 = 1 : \frac{4}{13} = 13 : 4$.

$\frac{\text{Area}\triangle ABC}{\text{Area}\triangle STU} = \frac{13}{4}$.

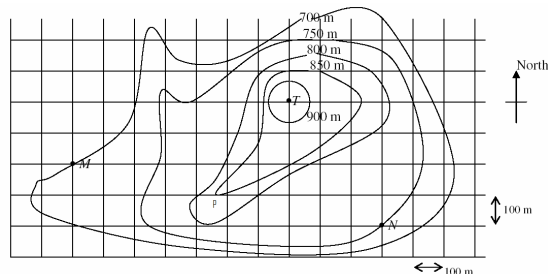


$\tan \theta = \frac{1000}{200}$, $\theta = \tan^{-1}(5) = 78.69^\circ$.

$360 - 78.69 = 281.31 \approx 281$.

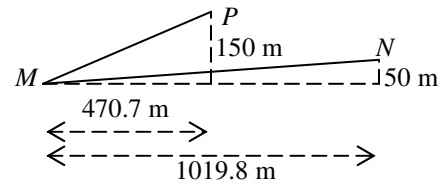
Bearing of M from N is 281°T .

Q3b



Horizontal distance from M to $N = \sqrt{1000^2 + 200^2} \approx 1019.8 \text{ m}$.

Horizontal distance from M to $P = \sqrt{460^2 + 100^2} \approx 470.7 \text{ m}$.



Slope of $MP = \frac{150}{470.7} \approx 0.32$ is greater than the slope of

$MN = \frac{50}{1019.8} \approx 0.05$.

$\therefore N$ could not be seen by M through binoculars.

Q3c $900 + 40 = 940 \text{ m}$.

Q3d

Horizontal distance from M to $T = \sqrt{700^2 + 200^2} \approx 728.0 \text{ m}$.

Horizontal distance from N to $T = \sqrt{300^2 + 400^2} = 500 \text{ m}$.

Angle of elevation of top of tower from M

$\theta_M \approx \tan^{-1}\left(\frac{940 - 700}{728.0}\right) \approx 18^\circ$.

Angle of elevation of top of tower from N

$\theta_N \approx \tan^{-1}\left(\frac{940 - 750}{500}\right) \approx 21^\circ$.

$\therefore \theta_N > \theta_M$.

Module 3: Graphs and relations

Q1a



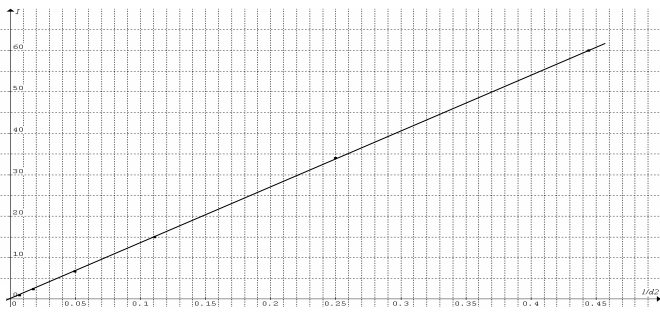
Q1b Average tax rate $= \frac{55,850 - 0}{180,000 - 6,000} \approx 0.321$, i.e. 32.1 cents for each dollar over \$6,000.

Q1c $\text{Tax payable} = 0.38(\text{income} - 80,000) + 17,850$.

$\text{Tax payable} = 0.38 \times \text{income} - 12,550$.

Q2a

$1/d^2$	0.4444	0.25	0.1111	0.0494	0.0178	0.0069
I	60	34	15	6.7	2.4	0.94



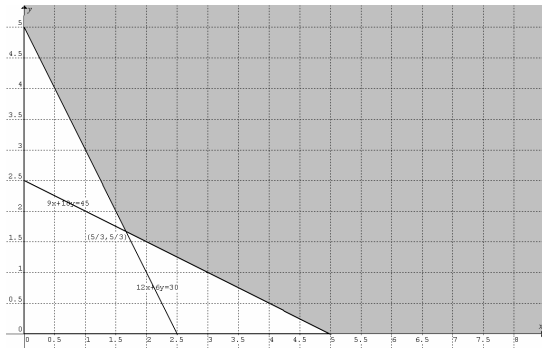
Q2b The points are on a straight line through the origin O.
Constant of proportionality is the gradient of the

$$\text{line} = \frac{60}{0.4444} \approx 135 \therefore I = \frac{135}{d^2}.$$

Q2c When $d = 0.6 \text{ m}$, $I = \frac{135}{0.6^2} = 375 \text{ lm/m}^2$.

Q3a Either $12x + 6y \geq 30$ or $9x + 18y \geq 45$.

Q3b



Q3ci $\$C = 3x + 4y$.

Q3cii Minimum cost at $\left(\frac{5}{3}, \frac{5}{3}\right)$. $\$C = 3\left(\frac{5}{3}\right) + 4\left(\frac{5}{3}\right) = \frac{35}{3}$.

Minimum cost per kg = $\frac{\frac{35}{3}}{\frac{5}{3} + \frac{5}{3}} = 3.50$, i.e. \$3.50 per kg.

Module 4: Business-related mathematics

Q1a Opening balance (\$) = $4282.16 + 3146.50 = 7428.66$.

Q1b Amount of Cheque 3211(\$)
= $4282.16 - (7803.51 - 4500.00) = 978.65$.

Q1c Minimum balance (\$) = $7803.51 - 4500.00 = 3303.51$

Interest (\$) = $\frac{3303.51 \times 1.75 \times \frac{1}{12}}{100} = 4.82$.

Q2a $\frac{164.4 - 100.0}{100.0} \times 100\% = 64.4\%$.

Q2b Let x be the 2009 March quarter CPI for Melbourne.

$$\frac{164.4 - x}{x} \times 100\% = 0.3\%, \quad 16440 - 100x = 0.3x,$$

$$100.3x = 16440, \quad x = 163.9.$$

Q2c $(100\% + 1.1\%)x = 10,000.00$, $\frac{101.1}{100}x = 10,000.00$,
 $x = 9891.20$.

Q3a Amount borrowed (\$)
= $375,000 + 12,200 - 85,000 - 23,000 = 279,200$.

Q3b Use TVM Solver to find PMT:

$N = 240$, $I = 5.91$, $\text{PMT} =$, $\text{PV} = 279200$, $\text{FV} = 0$, $\text{P/Y} = 12$,
 $\text{C/Y} = 12$

Monthly repayment PMT = \$1985.81

Q3c Use TVM Solver to find FV:

$N = 12$, $I = 5.91$, $\text{PMT} = -1985.81$, $\text{PV} = 279200$, $\text{FV} =$,
 $\text{P/Y} = 12$, $\text{C/Y} = 12$

Amount owing at the end of the first year FV = 271669.23.

Loan amount reduced = $279200 - 271669.18 = 7530.82$.

Amount paid in the first year = $1985.81 \times 12 = 23829.72$.

Interest paid in the first year = $23829.72 - 7530.82 = \$16298.90$.

Q3d After a year, the amount owing is \$271669.23, the remaining term is 228 months, new interest rate is 6.41% pa.

Use TVM Solver to find PMT:

$N = 228$, $I = 6.41$, $\text{PMT} =$, $\text{PV} = 271669.23$, $\text{FV} = 0$, $\text{P/Y} = 12$,
 $\text{C/Y} = 12$

Monthly repayment PMT = \$2063.70.

Increase in repayment = $2063.70 - 1985.81 = \$77.89$.

Q4a Loan amount = $12,500 - 500 = \$12,000$.

Total of 36 instalments = $420 \times 36 = \$15,120$.

Interest amount = $15,120 - 12,000 = \$3120$.

Q4b Flat rate $r = \frac{100I}{PT} = \frac{100 \times 3120}{12,000 \times 3} = 8.6667$.

Effective rate = $\frac{2n}{n+1} \times r = \frac{2 \times 36}{37} \times 8.6667 \approx 16.86$.

The effective interest rate p.a. is 16.86%.

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