

MAV Trial Examination Paper 2009
Further Mathematics
Examination 2 – SOLUTIONS

Core: Data Analysis

Question 1

a. Stem Leaf

7	4
8	2 5 8
9	2 6 7 8
10	1 5
11	0

Correct stem and Correct leaf
 Legend included

$$7 \mid 4 = 74 \text{ cm}$$

[A1]

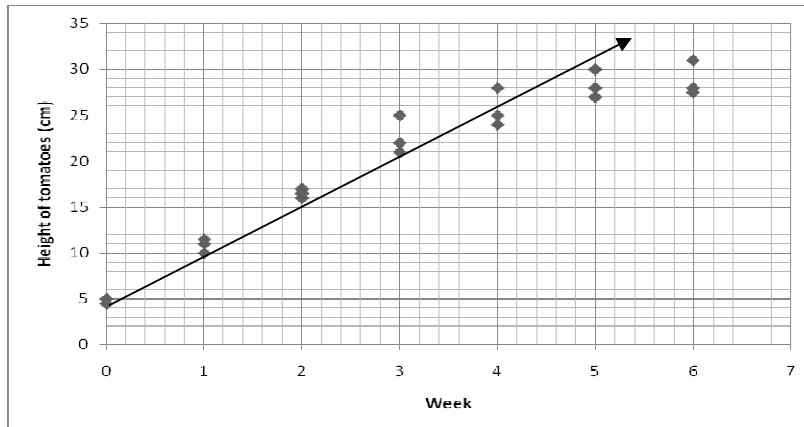
[A1]

- b. **For shape:** Supermarket tomatoes are normally distributed (or symmetrically distributed) whilst Allen's have a negatively skewed distribution. [A1]

For spread: Allen's tomatoes have a wider spread of weights – both in range and IQR. [A1]

Question 2

a.



The y-intercept is near 5 cm

[A1]

A reasonable attempt to balance the points on either side of the line.

[A1]

- b. Y-intercept given as approximately 5. [A1]

Gradient, with workings, is in the range of 4 to 5.

For example using the points (0, 5) & (3, 20)

$$m = \frac{(20 - 5)}{(3 - 0)}$$

$$= \frac{15}{3}$$

$$= 5$$

[M1]

Gives $y = 5x + 5$

States the equation using the variables names correctly ie.

Plant height = 5 x weeks + 5

[A1]

- c. Positive means that as the weeks pass (or weeks increase) the plant will grow taller (height increases) accordingly. [A1]

- d. Obviously not linear. So as the variable plant height has to be transformed use a y^2 transformation that is $(\text{Plant Height})^2$. [A1]

Question 3

- a.** The sum of indices of all four seasons is 4, therefore the missing index is 0.98.

$$0.90 + 0.98 + 1.14 + x = 4$$

$$x = 4 - 3.92$$

[A1]

$$= 0.98$$

Spring	Summer	Autumn	Winter
0.90	1.14	0.98	0.98

[A1]

- b.** The initial height of the plant when first planted.

[A1]

- c.** For every season that passes (time period) the plant will grow 0.1 metres in height.

[A1]

TOTAL 15 marks

END OF CORE SOLUTIONS

Module 1: Number Patterns

Question 1

a. $6 + 1.5 = 7.5$ m

[A1]

b. $t_2 - t_1 = 4.5 - 3 = 1.5$

$t_3 - t_2 = 6 - 4.5 = 1.5$

since $t_2 - t_1 = t_3 - t_2 = 1.5$ then the sequence is arithmetic

[A1]

c. using $S_n = \frac{n}{2}[2a + (n-1)d]$ where $n = 10$, $a = 3$, $d = 1.5$

$$S_{10} = \frac{10}{2}[2 \times 3 + (10-1)1.5]$$

$$= 5[6 + 9 \times 1.5]$$

$$= 97.5$$

[A1]

d. To find n when $S_n \geq 120$

Enter the general rule in the calculator to generate the sum sequence and then scroll down until the sum first exceeds 120. Read the value of n

Using the Casio Classpad

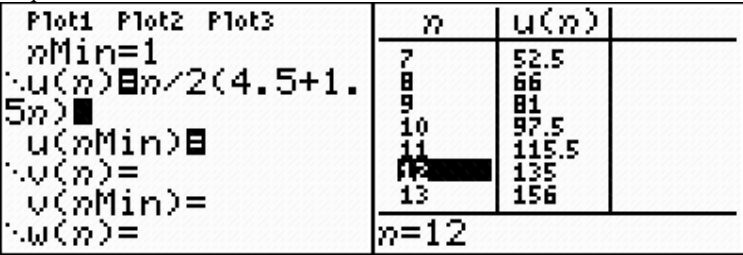
$$t_n = a + (n-1)d$$

$$t_n = 3 + (n-1)1.5$$

$$t_n = 1.5 + 1.5n$$

Enter the general rule
1.5 + 1.5n and turn the
Σ display on.

Using the TI 83/84

$S_n \geq 120$ $\frac{n}{2}[2a + (n-1)d] \geq 120$ $\frac{n}{2}[6 + (n-1)1.5] \geq 120$ $\frac{n}{2}[6 + 1.5n - 1.5] \geq 120$ $\frac{n}{2}[4.5 + 1.5n] \geq 120$	Enter $\frac{n}{2}[4.5 + 1.5n]$ in the calculator to generate the sum sequence 
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Answer: $n=12$

Tammy will be eligible after 12 lessons

[A1]

Question 2

a. $20 \times 0.08 = 1.6$, $20 - 1.6 = 18.4$

OR

decrease by 8% means $r = 1 - 0.08 = 0.92$

therefore during the second lesson a student makes an average of $20 \times 0.92 = 18.4$ errors.

18.4 errors

[A1]

b.

$$E_{n+1} = a \times E_n$$

$$E_2 = a \times E_1$$

$$18.4 = a \times 20$$

$$\therefore a = \frac{18.4}{20} = 0.92$$

[A1]

c. Find n when $E_n = 3$

Method 1: Using the calculator

Enter the difference equation $E_{n+1} = 0.92E_n$, $E_1 = 20$ in the calculator to generate the error sequence and scroll where the error first becomes less than 4.

Classpad

n	a _n	Σa _n
1	20	20
2	18.4	38.4
3	16.928	55.328
4	15.573	70.901
5	14.327	85.229

TI 83/84

n	u(n)
16	5.7259
17	5.2679
18	4.8464
19	4.4587
20	4.102
21	3.7739
22	3.472

n=21

Less than 4 errors would have been made in the 21st lesson.

[A1]

Method 2: Using algebra

Solve the general rule for a geometric sequence

$$a \times r^{(n-1)} < 4$$

$$20 \times 0.92^{n-1} < 4$$

this point you may enter the inequation in the calculator and solve or continue algebraically

$$0.92^{n-1} < \frac{4}{20}$$

$$n-1 > \frac{\log(0.2)}{\log(0.92)}$$

$$n-1 > 19.30$$

$$n > 20.30$$

$$\therefore n = 21$$

d. $S_n = \frac{a(1-r^n)}{1-r}$, where $a = 20$ and $r = 0.92$

$$= \frac{20(1-0.92^n)}{1-0.92} \quad \text{or} \quad \frac{20(1-0.92^n)}{0.08} \quad \text{or} \quad 250(1-0.92^n) \quad [\text{A1}]$$

e.

[M1]

$$\begin{aligned} S_{28} - S_{23} &= \frac{250(1-0.92^{28})}{1-0.92} - \frac{250(1-0.92^{23})}{1-0.92} \\ &= 225.79 - 213.267 \\ &= 12.5 \\ &= 13 \text{ errors} \end{aligned}$$

n	an	Σan
15	6.2238	178.42
16	5.7259	184.15
17	5.2678	189.41
18	4.8464	194.26
19	4.4587	198.72
20	4.102	202.82
21	3.7738	206.6
22	3.4719	210.07
23	3.1942	213.26
24	2.9386	216.2
25	2.7035	218.9
26	2.4872	221.39
27	2.2883	223.68
28	2.1052	225.78
29	1.9368	227.72

[A1]

Question 3

a.

Enter the difference equation in the calculator
 $M_4 = 4191$

Alternatively, using algebra

$$\begin{aligned} M_2 &= 1.06 \times M_1 - 180 \\ &= 1.06 \times 4000 - 180 \\ &= 4060 \end{aligned}$$

$$\begin{aligned} M_3 &= 1.06 \times M_2 - 180 \\ &= 1.06 \times 4060 - 180 \\ &= 4123.6 \end{aligned}$$

$$\begin{aligned} M_4 &= 1.06 \times M_3 - 180 \\ &= 1.06 \times 4123.6 - 180 \\ &= 4191 \end{aligned}$$

n	M_n
1	4000
2	4060
3	4123.6
4	4191
5	4262.4

[A1]

- b. $M_2 - M_1 = 4060 - 4000 = 60$ and $M_3 - M_2 = 4123.6 - 4060 = 63.6$
 $M_2 - M_1 \neq M_3 - M_2$ therefore the sequence is not arithmetic.

$$\frac{M_2}{M_1} = \frac{4060}{4000} = 1.015 \text{ and } \frac{M_3}{M_2} = \frac{4123.6}{4060} = 1.016$$

$$\frac{M_2}{M_1} \neq \frac{M_3}{M_2} \text{ therefore the sequence is not geometric.}$$

Both must be shown

[A1]

- c. If $M_{n+1} = M_n = 4000$ then

$$M_{n+1} = x \times M_n - 180$$

$$4000 = x \times 4000 - 180$$

$$4180 = 4000x$$

$$x = \frac{4180}{4000} = 1.045$$

A 4.5% increase

Alternatively increase by the amount that is removed,

$$x = \frac{180}{4000} \times \frac{100}{1} \% = 4.5\%$$

[A1]

- d.

Enter the difference equation in the calculator

$$S_4 = 4474$$

Alternatively, using algebra

$$S_3 = 1.10 \times S_2 - 0.12S_1 - 80$$

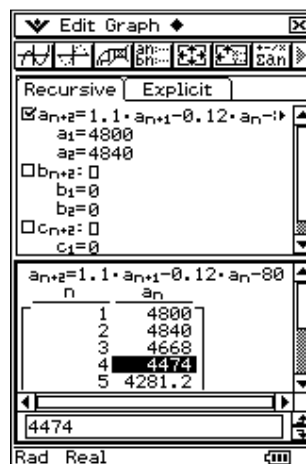
$$= 1.10 \times 4840 - 0.12 \times 4800 - 80$$

$$= 4668$$

$$S_4 = 1.10 \times S_3 - 0.12S_2 - 80$$

$$= 1.10 \times 4668 - 0.12 \times 4840 - 80$$

$$= 4474$$



[A1]

- e. Enter both difference equations in the calculator to find when $M_n > S_n$

$M_{n+1} = 1.06 \times M_n - 180, M_1 = 4000$	$S_{n+2} = 1.10S_{n+1} - 0.12S_n - 80,$ $S_1 = 4800, S_2 = 4840$

Enter the difference equations in y=	Go to the table and scroll down until you find $u(n) > v(n)$

This occurs in the sixth month ie. When $n = 6$ or June 2009

[A1]

Total 15 Marks

END OF MODULE 1 SOLUTIONS

Module 2: Geometry and Trigonometry

Question 1

- a. The angle at the centre of a regular polygon is given by $\frac{360}{n}$ where n is the number of sides.

$$\text{Therefore } \frac{360}{5} = 72^\circ \quad [\text{M1}]$$

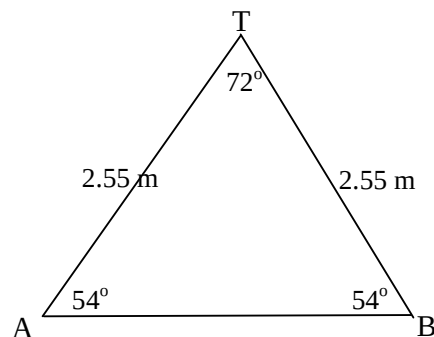
- b. i. ATB is an isosceles triangle.
Therefore $AT=BT=2.55$

$$\text{and } \angle TAB = \angle TBA = \frac{180^\circ - 72^\circ}{2} = 54^\circ$$

Using Cosine rule

$$\begin{aligned} AB^2 &= 2.55^2 + 2.55^2 - 2 \times 2.55 \times 2.55 \cos 72^\circ \\ &= 8.986 \end{aligned}$$

$$AB = \sqrt{8.986} = 3 \text{ m}$$



or

Using the Sine rule

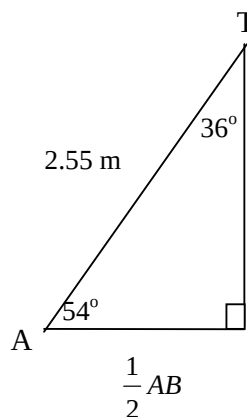
$$\begin{aligned} \frac{AB}{\sin 72^\circ} &= \frac{2.55}{\sin 54^\circ} \\ AB &= \frac{2.55}{\sin 54^\circ} \times \sin 72^\circ = 3 \text{ m} \end{aligned}$$

[M1]

or

Using Trig Ratios

$$\begin{aligned} \sin 36^\circ &= \frac{\frac{1}{2} AB}{2.55} \\ \frac{1}{2} AB &= 2.55 \times \sin 36^\circ \\ AB &= 2 \times 2.55 \sin 36^\circ = 3 \text{ m} \end{aligned}$$



[A1]

- b. ii. set up ratio $AD : AT$

$$\begin{aligned} 11 : 51 \\ x : 2.55 \end{aligned}$$

$$51x = 11 \times 2.55$$

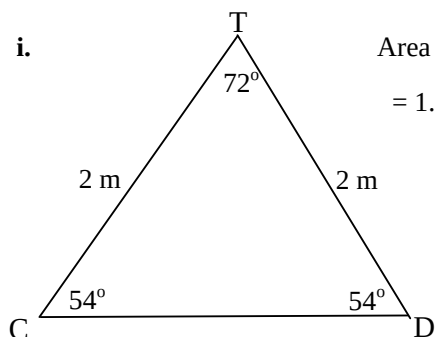
$$x = \frac{11 \times 2.55}{51}$$

$$x = 0.55$$

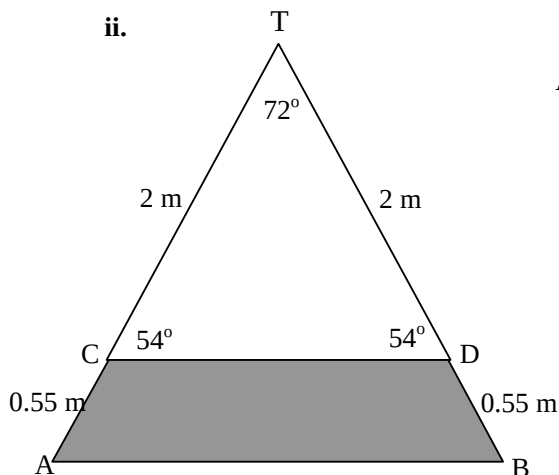
Therefore $AD = 0.55 \text{ m}$

[A1]

c. i. $\text{Area} = \frac{1}{2} \times 2 \times 2 \sin 72^\circ$ [M1]
 $= 1.902 \text{ m}^2$ [A1]



ii. $\text{Area ABT} = \frac{1}{2} \times 2.55 \times 2.55 \sin 72^\circ$
 $= 3.092 \text{ m}^2$
 $\text{Area ABCD} = 3.092 - 1.902 = 1.19 \text{ m}^2$ [A1]
So the area of the bench top is
 $= 5 \times 1.19 = 5.95 \text{ m}^2$ [A1]



Question 2

a.

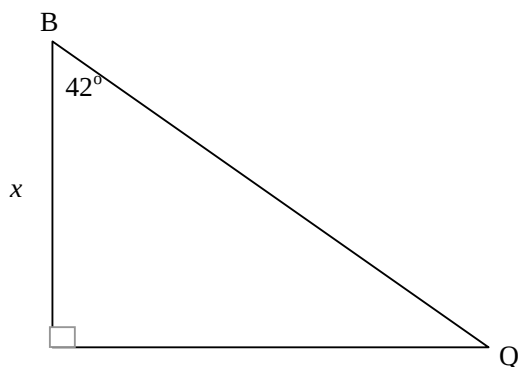
$$\begin{aligned} \angle RBQ &= 58^\circ + (360 - 318)^\circ \\ &= 58^\circ + 42^\circ \\ &= 100^\circ \end{aligned}$$
 [M1]

b. Angle at R is $\angle BRQ = 90 - 58 = 32^\circ$
Using the sine rule

$$\begin{aligned} \frac{QB}{\sin 32^\circ} &= \frac{12}{\sin 100^\circ} \\ QB &= \frac{12}{\sin 100^\circ} \times \sin 32^\circ \\ &= 6.5 \text{ m} \end{aligned}$$
 [M1]

[A1]

- c. The direct distance from B to the riverbank creates a right angle.

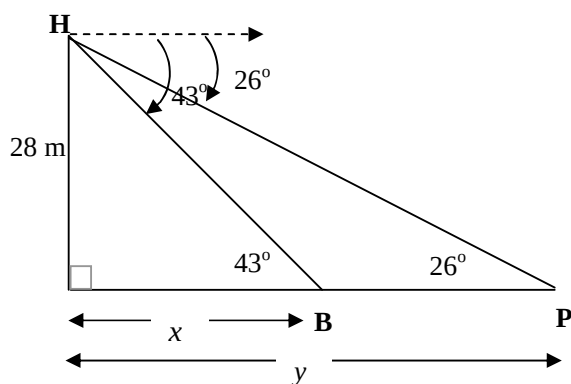


$$\cos 42^\circ = \frac{x}{BQ}$$

$$\begin{aligned} x &= BQ \times \cos 42^\circ \\ &= 6.5 \times \cos 42^\circ \\ &= 4.83 \text{ m} \end{aligned}$$

[A1]

- d. i.



$$\tan 43^\circ = \frac{28}{x}$$

$$\tan 26^\circ = \frac{28}{y}$$

$$\Rightarrow x = \frac{28}{\tan 43^\circ}$$

$$\Rightarrow y = \frac{28}{\tan 26^\circ}$$

$$BP = y - x$$

$$= \frac{28}{\tan 43^\circ} - \frac{28}{\tan 26^\circ}$$

$$= 57.41 - 30.03$$

$$= 27.38 \text{ m}$$

[M1]

[A1]

- d. ii. B is 4.83 m to the riverbank and 27.38 m to the opposite side of the riverbank
This means that the river is $27.38 - 4.83 = 22.55 \text{ m}$.

[A1]

Total 15 Marks

END OF MODULE 2 SOLUTIONS

Module 3: Graphs and Relations

Question 1

a. $R = 55n$ [A1]

b. i. $C = 240 + 5n$ [A1]

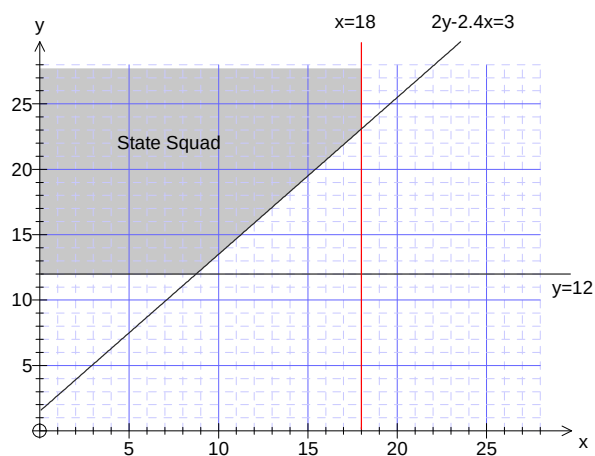
ii. To break even
 $R = C$
 $55n = 240 + 5n$
 $50n = 240$
 $n = \frac{240}{50}$
 $n = 4.8$
 5 teams to break even [A1]

c. Profit = Revenue – Cost
 $= 55n - (240 + 5n)$
 $= 50n - 240$
 If the Profit = \$910 then
 $50n - 240 = 910$
 $50n = 1150$
 $n = \frac{1150}{50} = 23$
 23 teams [A1]

Question 2

a. The soccer competitors need to be able to run 100m in 18 seconds or less. [A1]

b.



Each line correctly drawn and labelled (1 mark each) [A3]
 Shaded region correct [A1]

- c. The competitor must satisfy the inequality $2y - 2.4x \geq 3$ where $y=14$

$$\begin{aligned} 2y - 2.4x &\geq 3 \\ 2 \times 14 - 2.4x &\geq 3 \\ 28 - 2.4x &\geq 3 \\ -2.4x &\geq -25 \\ x &\leq \frac{-25}{-2.4} \\ x &\leq 10.42 \text{ seconds} \end{aligned}$$



The minimum time is 10.42 seconds

[A1]

- d. To determine whether $(6, 23)$ satisfies all inequalities substitute $x=6$ and $y=23$.

Inequality 1; $x \leq 18$ is true since $x = 6$

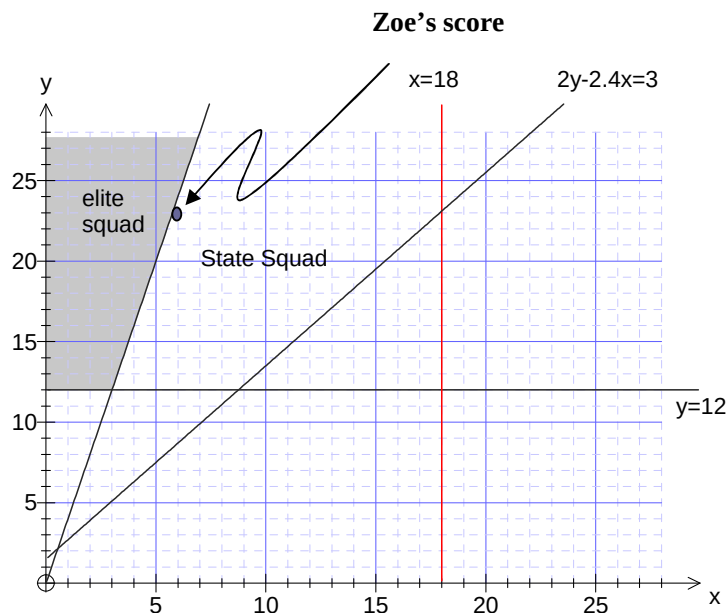
Inequality 2: $y \geq 12$ is true since $y = 23$

Inequality 3: $2y - 2.4x \geq 3$ is true since $2 \times 23 - 2.4 \times 6 = 31.6 \geq 3$

Inequality 4: $y - 4x \geq 0$ is not true since $23 - 4 \times 6 = -1 < 0$

Therefore Zoe is in the state squad but is not in the elite squad

[A1]

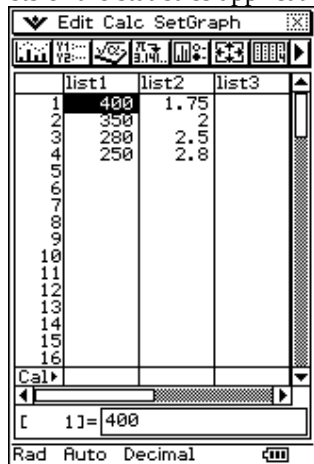


Question 3

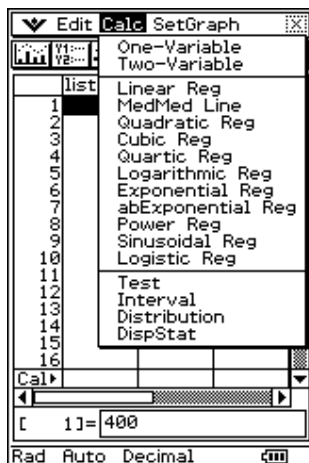
a.

Method 1: Using the Calculator

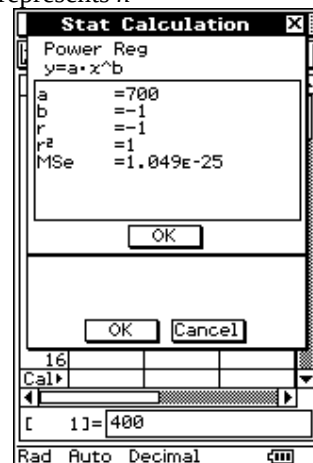
Step 1: Enter the values in the Lists of the statistics application



Step 2: Go to Calc and select the Power Reg option



Step 3: The value of a represents k and the value of b represents n



L1	L2	L3	2
400	1.75	-----	
350	2		
280	2.5		
250	2.8		
-----	-----		
L2(5) =			

```

EDIT [MODE] TESTS
5: QuadReg
6: CubicReg
7: QuartReg
8: LinReg(a+bx)
9: LnReg
0: ExpReg
1: PwrReg

```

```

PwrReg
y=a*x^b
a=700
b=-1

```

$$k = 700$$

$$n = -1$$

[A1]

[A1]

Method 2: Using Algebra

Step 1: Use two points to set up equations

Substituting (400, 1.75) gives

$$1.75 = k \times 400^n \quad \text{equation 1}$$

substituting (350, 2.00) gives

$$2.00 = k \times 350^n \quad \text{equation 2}$$

At this stage you can enter these into the calculator and solve as simultaneous equations



or continue algebraically to step 2

Step 2: Eliminate k
equation 2 $\div$ equation 1

$$\frac{2.00}{1.75} = \frac{k \times 350^n}{k \times 400^n}$$

$$\frac{2.00}{1.75} = \frac{350^n}{400^n}$$

$$\frac{2.00}{1.75} = \left(\frac{350}{400}\right)^n$$

$$n = \frac{\log\left(\frac{2}{1.75}\right)}{\log\left(\frac{350}{400}\right)} \quad \therefore n = -1$$

Step 3: sub into equation 2 gives

$$2.00 = k \times 350^{-1}$$

$$k = 2.00 \times 350 = 700$$

b. Using the rule $F = 700S^{-1}$ or $F = \frac{700}{S}$
substituting $S = 195$ gives $F = \frac{700}{195} = \$3.60$

[A1]

c. Using the rule $F = 700S^{-1}$ or $F = \frac{700}{S}$
substituting $F = 4$ gives

$$4 = \frac{700}{S}$$
$$S = \frac{700}{4}$$
$$= 175 \text{ spectators}$$

[A1]

Total 15 Marks

END OF MODULE 3 SOLUTIONS

Module 4: Business related mathematics

Question 1

a. $110\% \rightarrow 3800 + x$

$100\% \rightarrow x$

$$\frac{110\%}{100\%} = \frac{3800 + x}{x}$$

$$x = (3800 + x) \times \left(\frac{100}{110} \right) \quad [\text{A1}]$$

$$11x = 38\,000 + 10x$$

$$x = \$38\,000$$

b. Cost price = \$33 000

Deposit = \$3000

Balance = \$30 000

Hire purchase loan (simple interest)

$$I = \frac{PrT}{100}$$

$$= \frac{30\,000 \times 3 \times 3}{100} \quad [\text{M1}]$$

$$= \$2700$$

$$\text{Monthly} = \frac{(2700 + 30\,000)}{36} \quad [\text{A1}]$$

$$= \$908.33$$

c.

$$\text{Effective rate} = \frac{2n}{n + 1} \times \text{flat rate}$$

$$= \frac{72}{37} \times 3\% \quad [\text{A1}]$$

$$= 5.84\% \text{ p.a.}$$

d.

$$\text{Stamp Duty} = \frac{33\,000}{200} \times 5$$

$$= 165 \times 5 \quad [\text{A1}]$$

$$= \$825$$

Question 2

a. Because effectively the 3% simple interest rate is higher (effective rate of 5.84%) than the compound rate of 5%. [A1]

b.

$$A = PR^n$$

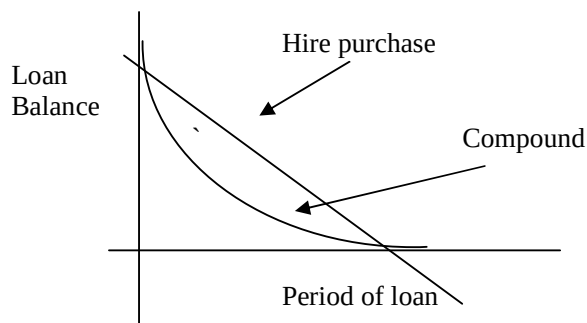
$$= 33\,000 \times 1.004116666^{36}$$

$$= \$38\,328.58 \quad [\text{A1}]$$

$$\text{Equal mthly instal.} = \frac{38\,328}{36}$$

$$= \$1064.68$$

- c. Hire purchase straight line. [A1]
Compound curved. [A1]
NB. Deduct 1 mark if they do not start at the same initial loan balance (same y-intercept)



Question 3

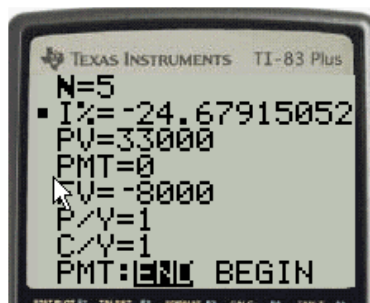
a.

$$BV = P \left(1 - \frac{r}{100}\right)^n$$

[M1]

$$8000 = 33\,000 \times \left(1 - \frac{r}{100}\right)^5$$

Or show the table of values similar to those on a finance solver.



The reducing balance rate of depreciation is 24.7%

[A1]

b. After 2 yrs

$$\text{bookvalue} = 33\,000 \times \left(1 - \frac{24.7}{100}\right)^2$$

Use the finance solver on a graphics calculator to evaluate.



V = \$18 711

[A1]

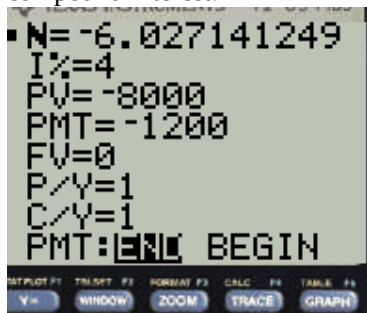
- c. Dist. Travelled= 80 000 kms
 Depreciation = \$33 000 - \$8000 [A1]
 = \$25 000 for 80 000 kms
 = x for 100kms

$$x = 25\,000 \times \frac{100}{80\,000}$$

 = \$31.25/100kms [A1]

Question 4

Use finance solver as this is an example of an annuity where there is a regular payment with a compound interest.



Six years of scholarships before the funds run out. [A1]

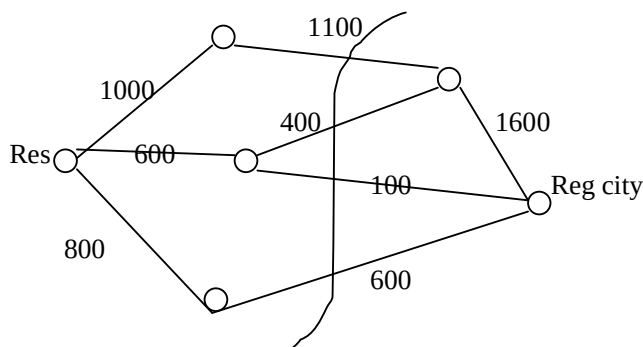
Total 15 Marks

END OF MODULE 4 SOLUTIONS

Module 5: Networks and decision mathematics

Question 1

a.



[A1] [A1]

b. Using count back method 2100 max flow

[A1]

c. 2100 megalitres

[A1]

Question 2

a. 9 weeks

[A1]

b. C, F, G, H, J

[A1]

c. A - float time 1.5 weeks

[A1]

D - float time 1.5 weeks

[A1]

Question 3

a. Euler Path – odd vertices. $\therefore$ D & E

[A1]

b. The main criteria for an Euler path is the need to use each edge once only. Starting position is not specific so either D or E is appropriate.

[A1]

c. D – C – A – B – D – E – F – G – B – E or
D – C – A – B – D – E – B – G – F – E

[A1]

d. D $\rightarrow$ E All vertices would then be even.

[A1]

e. Hamiltonian Path is the most appropriate path because he needs to pass through each worksite exactly once.

[A1]

He has no need to start and finish at the same worksite; therefore it needn't be a circuit.

[A1]

He doesn't need to travel each road, therefore not Euler.

[A1]

Total 15 Marks

END OF MODULE 5 SOLUTIONS

Module 6: Matrices

Question 1

a.

$$\frac{1}{2} \begin{bmatrix} 3200 & 2600 & 1700 & 1400 \\ 2800 & 2400 & 1600 & 1300 \\ 2400 & 2100 & 1400 & 1200 \end{bmatrix} = \begin{bmatrix} 1600 & 1300 & 850 & 700 \\ 1400 & 1200 & 800 & 650 \\ 1200 & 1050 & 700 & 600 \end{bmatrix} \quad [\text{A1}]$$

b.

$$\begin{bmatrix} 0.9 & 0 & 0 & 0 \\ 0 & 0.8 & 0 & 0 \\ 0 & 0 & 0.6 & 0 \\ 0 & 0 & 0 & 0.5 \end{bmatrix}, \quad [\text{A1}]$$

c.

$$\begin{bmatrix} 3200 & 2600 & 1700 & 1400 \\ 2800 & 2400 & 1600 & 1300 \\ 2400 & 2100 & 1400 & 1200 \end{bmatrix} \begin{bmatrix} 0.9 & 0 & 0 & 0 \\ 0 & 0.8 & 0 & 0 \\ 0 & 0 & 0.6 & 0 \\ 0 & 0 & 0 & 0.5 \end{bmatrix} = \begin{bmatrix} 2880 & 2080 & 1020 & 700 \\ 2520 & 1920 & 960 & 650 \\ 2160 & 1680 & 840 & 600 \end{bmatrix}$$

Use a graphics calculator to evaluate.

[A1]

d. The element's position is row 2, column 3 or $e_{2,3}$ for a discounted price of \$960.

[A1]

Question 2

a.

$$2x + 5y + 10z = 44000$$

$$4y + 5z = 22000$$

$$3x + 4y + z = 27500$$

All three correct

[A2]

Only 2 correct (1 mark)

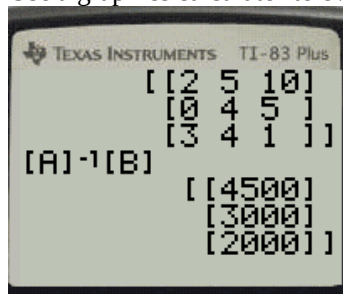
b.

$$\begin{bmatrix} 2 & 5 & 10 \\ 0 & 4 & 5 \\ 3 & 4 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 44000 \\ 22000 \\ 27500 \end{bmatrix}$$

$$A \quad X = B$$

$$X = A^{-1}B \quad [\text{M1}]$$

Use a graphics calculator to evaluate.



$$\begin{bmatrix} 4500 \\ 3000 \\ 2000 \end{bmatrix}$$

[A1]

Stateroom \$4500
Balcony \$3000
Inner Cabin \$2000

Student needs to interpret each of the elements of the solution appropriately.

[A1]

Question 3

a.

$$\begin{bmatrix} \frac{9}{10} & \frac{1}{5} & \frac{1}{10} \\ \frac{8}{100} & \frac{7}{10} & \frac{3}{10} \\ \frac{2}{100} & \frac{1}{10} & \frac{6}{10} \end{bmatrix} \text{ or } \begin{bmatrix} 0.9 & 0.2 & 0.1 \\ 0.08 & 0.7 & 0.3 \\ 0.02 & 0.1 & 0.6 \end{bmatrix}$$

[A1]

b.

$$H_{2008} = \begin{bmatrix} 50\,000 \\ 100\,000 \\ 150\,000 \end{bmatrix}$$

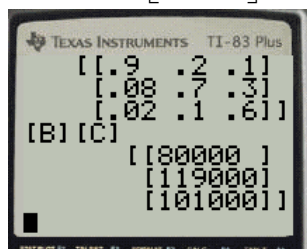
[A1]

c.

$$T \times H_{2008} = \begin{bmatrix} 0.9 & 0.2 & 0.1 \\ 0.08 & 0.7 & 0.3 \\ 0.02 & 0.1 & 0.6 \end{bmatrix} \begin{bmatrix} 50\,000 \\ 100\,000 \\ 150\,000 \end{bmatrix}$$

$$= \begin{bmatrix} 80\,000 \\ 119\,000 \\ 101\,000 \end{bmatrix} \begin{matrix} \text{Cruise} \\ \text{Tour} \\ \text{Resort} \end{matrix}$$

[A1]



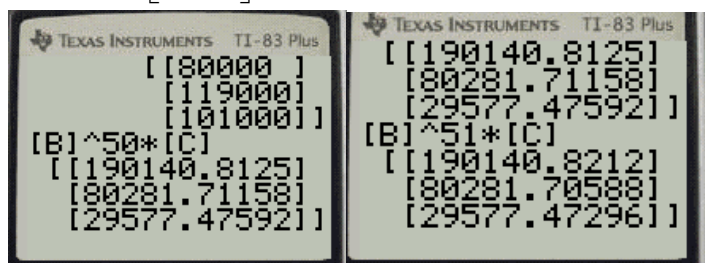
80 000 for cruise, 119 000 for tours and 101 000 for resort

[A1]

d.

$$T \times H_{2008} = \begin{bmatrix} 0.9 & 0.2 & 0.1 \\ 0.08 & 0.7 & 0.3 \\ 0.02 & 0.1 & 0.6 \end{bmatrix}^{50} \begin{bmatrix} 50\,000 \\ 100\,000 \\ 150\,000 \end{bmatrix}$$

$$= \begin{bmatrix} 190\,141 \\ 80\,282 \\ 29\,577 \end{bmatrix} \begin{matrix} \text{Cruise} \\ \text{Tour} \\ \text{Resort} \end{matrix} \quad (\text{rounded})$$



$$T \times H_{2008} = \begin{bmatrix} 0.9 & 0.2 & 0.1 \\ 0.08 & 0.7 & 0.3 \\ 0.02 & 0.1 & 0.6 \end{bmatrix}^{51} \begin{bmatrix} 50\,000 \\ 100\,000 \\ 150\,000 \end{bmatrix}$$

$$= \begin{bmatrix} 190\,141 \\ 80\,282 \\ 29\,577 \end{bmatrix} \begin{matrix} \text{Cruise} \\ \text{Tour} \\ \text{Resort} \end{matrix}$$

Setting n to a large number say 50.
Showing the next transition eg $n=51$

[A1]
[A1]

Total 15 Marks

END OF EXAMINATION 2 SOLUTIONS