The Mathematical Association of Victoria

Trial Examination 2019

FURTHER MATHEMATICS

Trial Written Examination 1 - SOLUTIONS

SECTION A: Core

Question	Answer	Question	Answer
1	C	**13**	D
2	D	**14**	E
3	D	**15**	A
4	D	**16**	E
5	E	**17**	B
6	B	**18**	A
7	B	**19**	D
8	B	**20**	E
9	A	**21**	E
10	A	**22**	E
11	C	**23**	C
12	A	**24**	D

SECTION B : Modules

1 – Matrices

	Answer
1	B
2	E
3	C
4	B
5	B
6	E
7	C
8	C

2 –Networks and Decision Maths

Question	Answer
1	D
2	A
3	D
4	B
5	D
6	D
7	E
8	C

3 – Geometry and Trigonometry

	Answer
1	C
2	A
3	E
4	D
5	B
6	A
7	D
8	E

4 – Graphs and Relations

Question	Answer
1	D
2	A
3	C
4	D
5	E
6	C
7	A
8	C

Core - Data Analysis

Question 1 Answer C

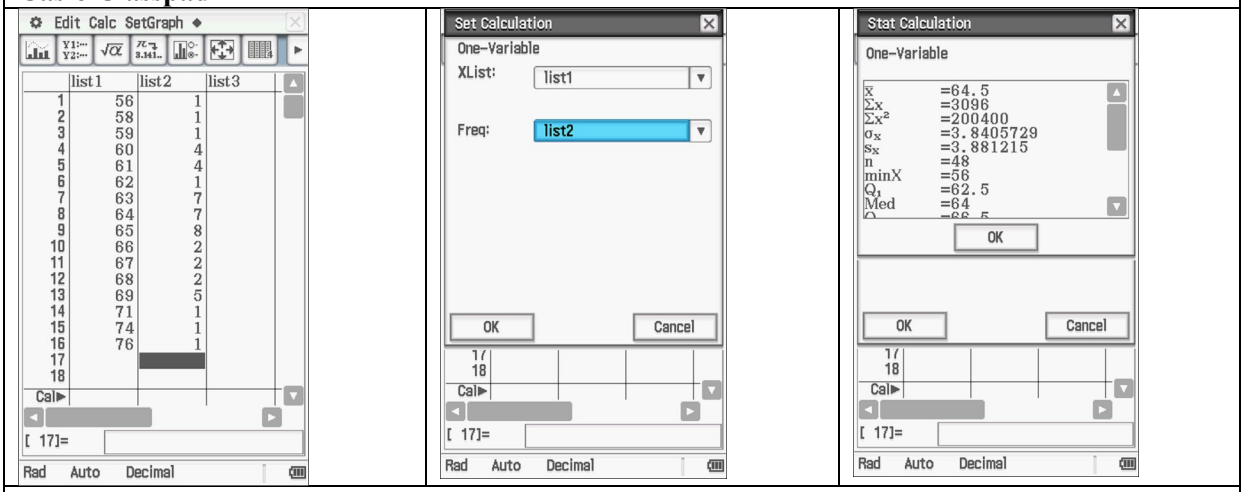
The number of students who are less than 60 months of age is 3 (56, 58 and 59)

$\frac{3}{48} \times 100 = 6.25\%$ The closest, whole number, answer is 6%

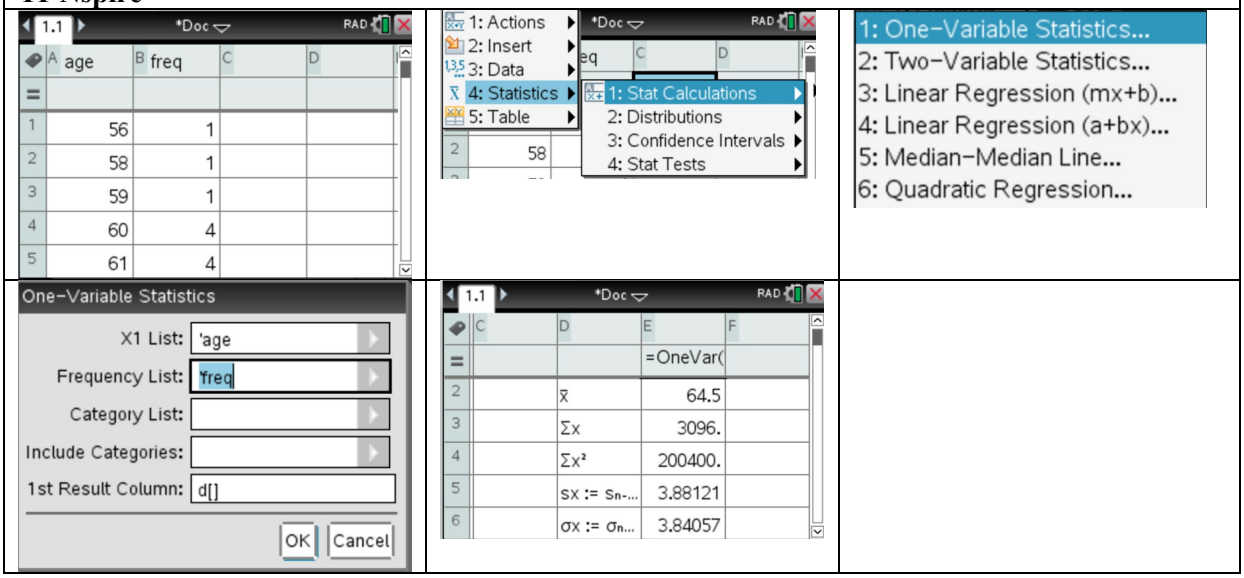
Question 2 Answer D

Use the Statistics mode of your calculator using a frequency table as shown below:

Casio Classpad



TI-Nspire



Question 3 Answer D

Options A, B and C are all correct definitions.
The mean number of hours for a sample may be the same as the population, but it is not always the case and is unlikely, so option D is not true as required by the question.
If random sampling is performed then option E is true by definition of the process of random sampling.

Question 4 Answer D

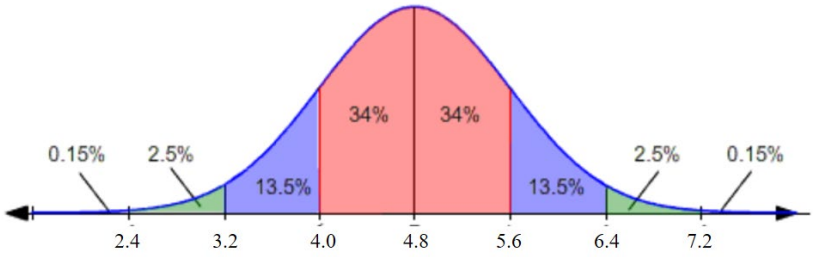
1990 has a median of 80.5 and an IQR of 26.
2010 has a median of 89 and an IQR of 14.

A.	The distributions are negatively skewed.	False
B.	The lowest of the 2010 immunisation rates is 46, the lower quartile for 1990 is 60.	False
C.	The immunisation rates for 2010 have a higher median but less variation, the 1QR for 2010 is smaller than the IQR for 1990.	False
D.	The 1QR for 2010 is 14. This is smaller than the IQR for 1990 which is 26.	True
E.	There is a difference between the median immunisation rates for 1990 and 2010, so there is an association.	False

Question 5 Answer E

The $\log_{10}(10\,000) = 4$ and the scale on vertical axis is <u>percentage</u> frequency.
The percentage of countries with a GDP less than \$US 10 000 million is $1 + 5 = 6$.
The percentage of countries with a GDP greater than \$US 10 000 million is $100 - 6 = 94$.

Question 6 Answer B



The normal distribution for this data is shown above. As can be seen $\bar{x} - S_x = 4.8 - 0.8 = 4.0$ and so there are (0.15+2.35+13.5) = 16% of values less than 4.0 mmol/L and (100 – 16) = 84% above.

The percentage of adult males with cholesterol levels greater than 4.0 mmol/L is expected to be 84%.

84% of 50 is 42.

Question 7 Answer B

	2008	2018
Mode	20	21 and 24
Lowest Value	14	16
Q_1	19	21
Median	20	25
Q_3	25	31
Upper value	32	37
Range	18	21
IQR	6	10
$Q_1 - 1.5 \times IQR$	$19 - 9 = 10$	$21 - 15 = 6$
$Q_3 + 1.5 \times IQR$	$25 + 9 = 34$	$31 + 15 = 46$

A. The median and mode for 2008 is 20.	True
B. The range and IQR for 2008 are smaller than the range and IQR for 2018. There is therefore less variation in the 2008 maximum daily temperatures than the 2018 maximum daily temperatures.	False
C. There are no values less than 10 (lower fence) or greater than 34 (upper fence), so there are no outliers	True
D. 25 (median for 2018) is 5 more than 20 (median for 2008)	True
E. The interquartile range for 2018 is 10	True

Question 8 Answer B

Segmented bar charts would be an appropriate graphical tool investigate the association between two categorical variables. *Support for gun control* is a categorical variable and the only categorical variable in the responses is *gender*.

Question 9 Answer A

- The correct interpretation of this strong positive correlation is that 'as *male literacy rates* increase the *female literacy rates* tend to increase'.
- It has nothing to do with the response variable as a percentage of the explanatory variable (B).
- The high correlation coefficient implies that there is a strong, positive linear relationship (C) but we cannot assume causation (D).
- The correlation coefficient is not the gradient of a possible least squares regression line (E).

Question 10 Answer A

The scale of the graph does not allow for complete accuracy reading but it appears that the two points (76, 58) and (95, 86) lie on the least squares regression line.

For $y = a + bx$ $\quad b = \frac{86-58}{95-76} = 1.47 \quad 86 = a + 1.47(95) \quad a = -53.65$

Students may chose different points and get slightly different answer.
The scale for the explanatory variable does not go back to zero, so a cannot be read off the graph and would not be 48.

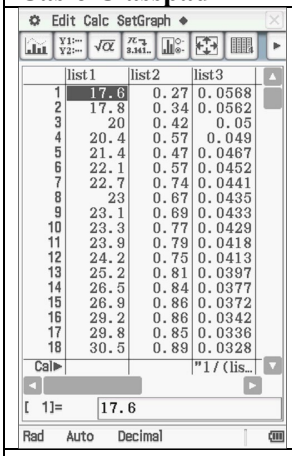
Question 11 Answer C

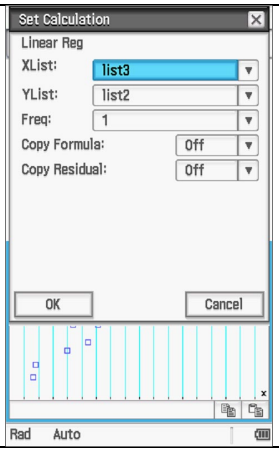
$r = 0.892 \quad r^2 = 0.796$

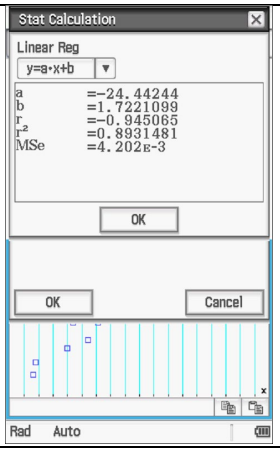
The correct response has r^2 as a percentage variation of the response variable explained by the variation in the explanatory variable. Therefore 79.6% of the variation in *HDI* can be explained by the variation in the *age at first marriage*

Question 12 Answer A

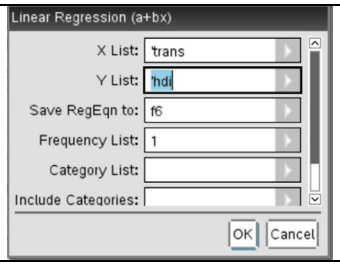
Casio Classpad

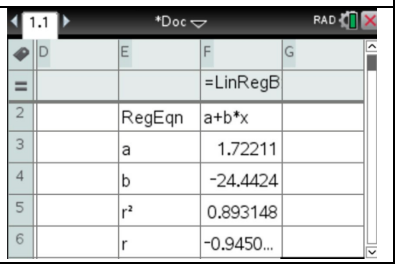






TI-Nspire

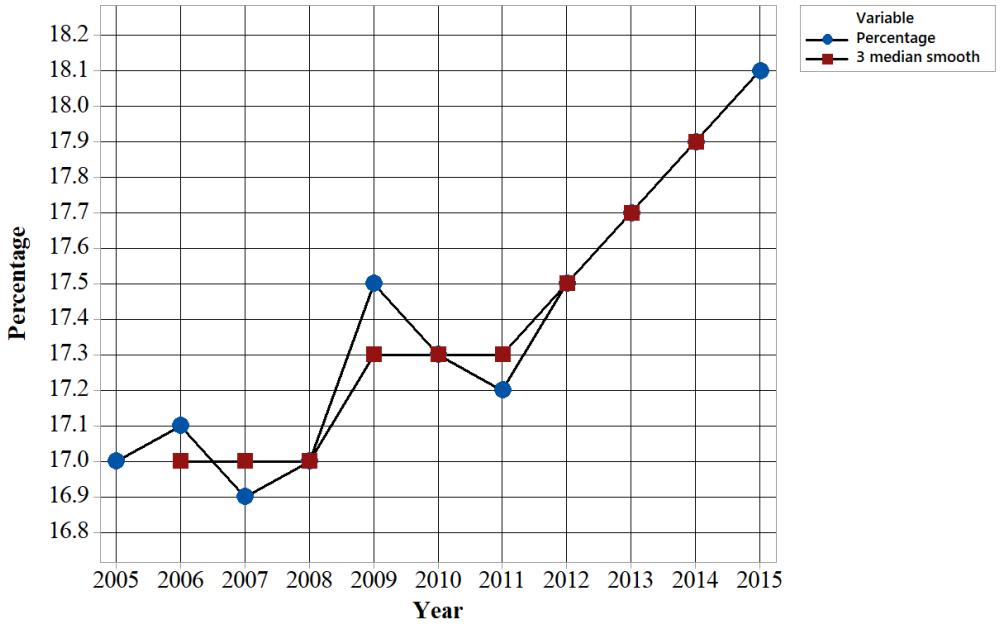




The calculator gives the gradient as $-24.44244\ldots$ Correct to two significant figures this is -24.

Question 13 Answer D

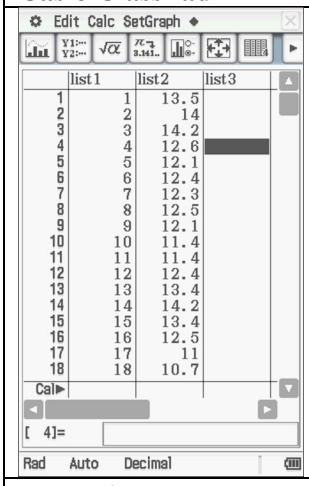
The smoothed graph is shown below. The median of 17.0, 17.5 and 17.3 is required. This would be 17.3.

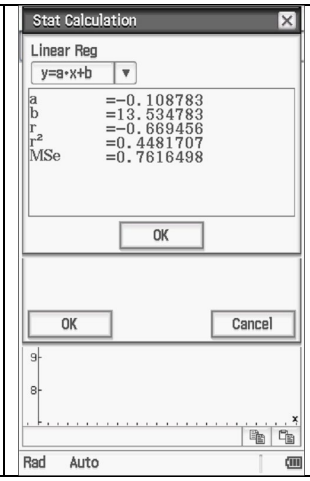


Question 14 Answer E

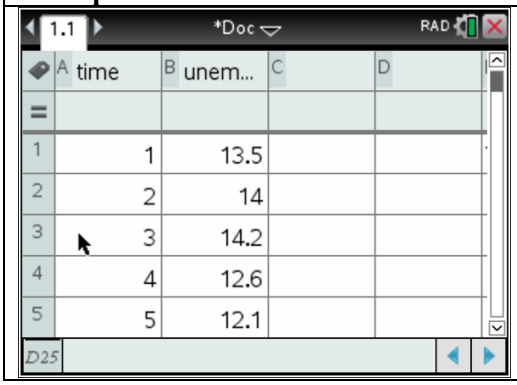
The equation of the least squares regression line is *percentage unemployed* $= 13.53 - 0.11t$.

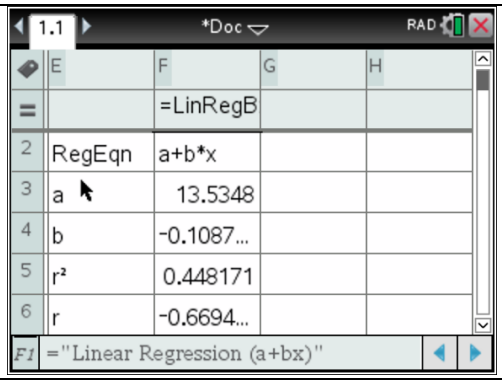
Casio ClassPad





TI-Nspire





Question 15 Answer A

The seasonal index for November is 0.91.

$1 - 0.91 = 0.09$

$0.09 \times 100 = 9$

Therefore the unemployment figures for November are 9% lower than the yearly average.

Question 16 Answer E

Year	Temperature	4 point moving average	Centred moving average
1960	13.920		
1965	13.822		
		$\frac{13.920 + 13.822 + 13.937 + 13.903}{4} = 13.8955$	
1970	13.937		$\frac{13.8955+13.9565}{2} = 13.926$
		$\frac{13.822 + 13.937 + 13.903 + 14.164}{4} = 13.9565$	
1975	13.903		
1980	14.164		

Core – Recursion and Financial Modelling

Question 17 Answer B

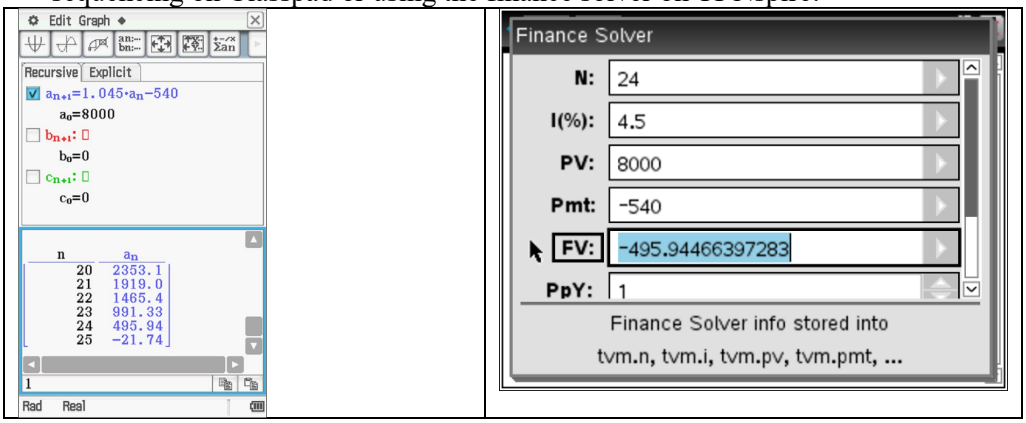
$\frac{50.4}{1200} \times 100 = 4.2\%$

Question 18 Answer A

An interest only loan does not change value because the interest is equal to the repayments.

The balance does not change, so after any period of time it will remain at $20 000.

Question 19 Answer D

A. $1+\frac{r}{100}=1.045 \quad r=4.5\%$	True
B. $\frac{4.5}{100}\times 12\,000=540$ so the repayment equals the interest, interest only loan.	True
C. $\frac{4.5}{100}\times 15\,000=675$ so the repayment is less than the interest, loan balance will increase because payments are less than interest.	True
D. The loan will not quite be paid off in 24 payments. This can be seen using sequencing on Classpad or using the finance solver on TI-Nspire:  A balance of \$495.94 remains to be paid.	False
E. The loan payment is \$540 each time period as this is the amount subtracted from the balance each time period.	True

Question 20 Answer E

Investment A has a linear graph and is simple interest with an initial balance of \$3000 and $\frac{1800}{4}=\$450$ added each year. Option A is incorrect because Investment A is simple interest.

The interest rate for investment A is $\frac{450}{3000}\times 100=15\%$.

Investment B is a curve so it is a compound interest investment (option B is incorrect) with an initial balance of \$2000 and an interest rate of $\frac{300}{2000}\times 100=15\%$.

Therefore Investments A and B have the same interest rate of 15%. Option C is incorrect.

Option D is incorrect because Investment B is below Investment A at 8 years.

n	Investment A	Investment B (nearest dollar)	Difference
0	3000	2000	\$1000
1	3450	2300	\$1150
2	3900	2645	\$1255
3	4350	3042	\$1308
4	4800	3498	\$1302
5	5250	4023	\$1227

Difference increases and then decreases. Difference is not greater than \$1500, so Answer E is correct.

Question 21 Answer E

$$r_{effective} = \left[(1 + \frac{r}{100n})^n - 1\right] \times 100$$

Initial investment

$$r_{effective} = \left[(1 + \frac{4.7}{100\times4})^4 - 1\right] \times 100 = 4.783488$$

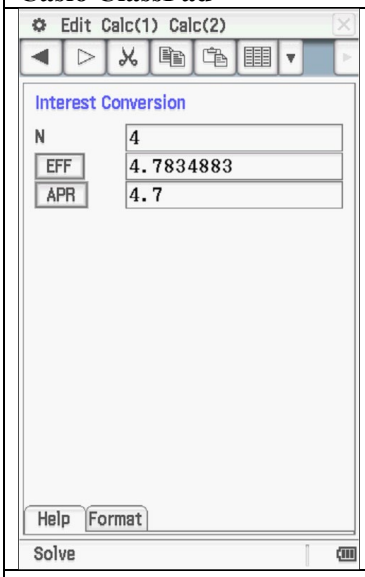
Second bank

$$r_{effective} = \left[(1 + \frac{5.3}{100\times12})^{12} - 1\right] \times 100 = 5.430660$$

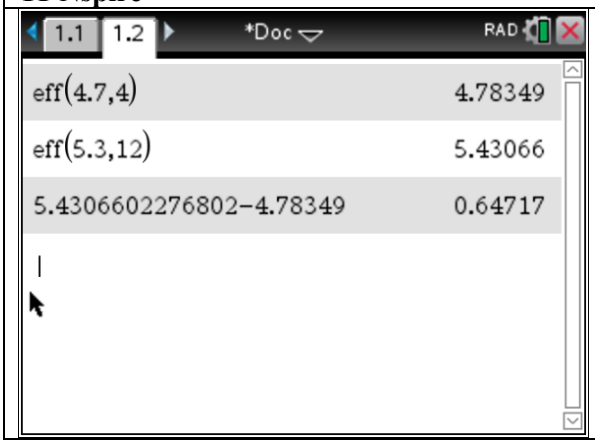
$5.430660 - 4.783488 = 0.647172$ .... %

Using the calculator:

Casio ClassPad



TI-Nspire



Question 22 Answer E

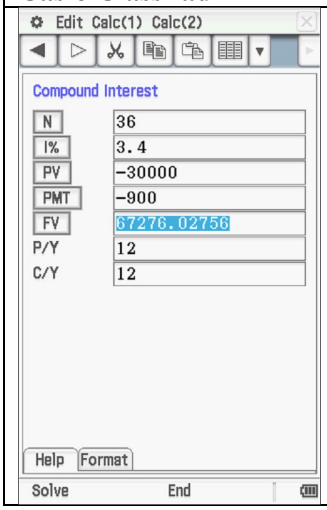
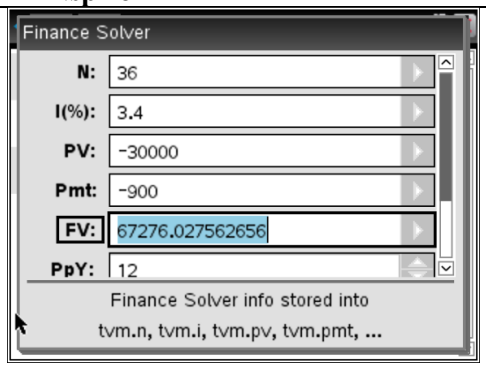
$Depreciation = 140\,000 - 71\,000 = 69\,000$

Number of 5000 page sets printed $= \frac{69000}{4.6} = 15000$

Number of pages $= 15000 \times 5000 = 75\,000\,000$

Question 23 Answer C

The amount in Petra's account at the end of 3 years is shown to be \$67 276.03 below:

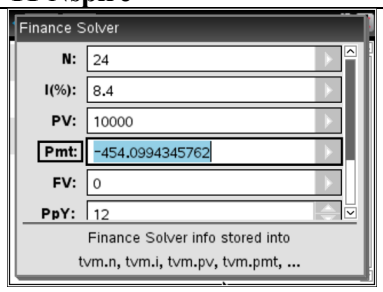
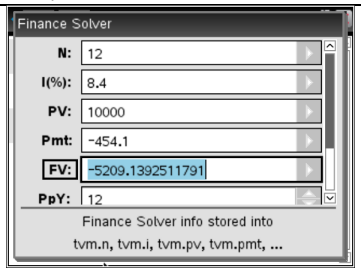
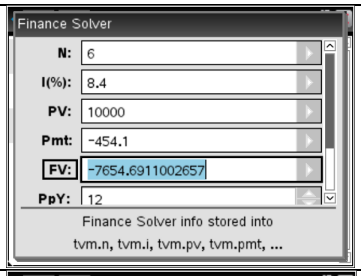
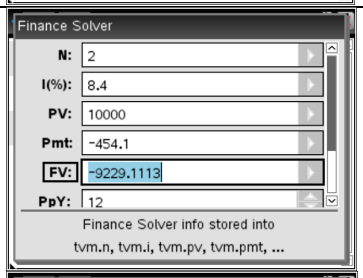
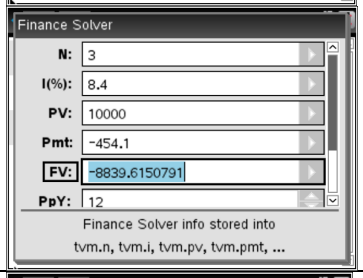
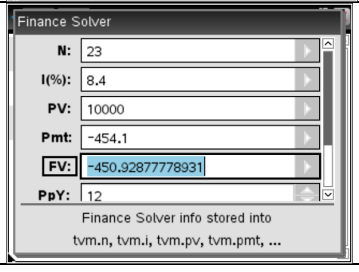
Casio ClassPad	TI-Nspire
	

The interest earned is the final balance less the principal and payments made by Petra:

$67276.03 - (30\,000 + 900 \times 36) = \$4876.03$

Question 24 Answer D

The payment of $454.10 per month must be determined first:

<table>
<tr><th colspan="2">Casio ClassPad</th><th colspan="3">TI-Nspire</th></tr>
<tr><td colspan="2">Compound Interest
N 24
I% 8.4
PV 10000
PMT −454.0994346
FV 0
P/Y 12
C/Y 12</td><td colspan="3">  </td></tr>
<tr><td>A.</td><td colspan="4">Interest = $454.10 \times 24 - 10000 = \$898.40$</td><td>True</td></tr>
<tr><td>B.</td><td>Compound Interest
N 12
I% 8.4
PV 10000
PMT −454.1
FV −5209.139251
P/Y 12
C/Y 12</td><td>  </td><td></td><td>True</td></tr>
<tr><td>C.</td><td>Compound Interest
N 6
I% 8.4
PV 10000
PMT −454.1
FV −7654.6911
P/Y 12
C/Y 12</td><td>  </td><td>Balance is $7654.69 so $10000 – 7654.69 = $2345.31</td><td>True</td></tr>
<tr><td>D.</td><td>Compound Interest
N 2
I% 8.4
PV 10000
PMT −454.1
FV −9229.1113
P/Y 12
C/Y 12
Compound Interest
N 3
I% 8.4
PV 10000
PMT −454.1
FV −8839.615079
P/Y 12
C/Y 12</td><td> 
  </td><td>The principal reduction in the third month is 9229.11 – 8839.62 = $389.49 not $392</td><td>Not True</td></tr>
<tr><td>E.</td><td>Compound Interest
N 23
I% 8.4
PV 10000
PMT −454.1
FV −450.9287778
P/Y 12
C/Y 12</td><td>  </td><td>The balance would be closest to $451</td><td>True</td></tr>
</table>

Module 1: Matrices

Question 1 Answer B

$-4 - 3x = 8 \quad x = -4$

Question 2 Answer E

The matrix is binary (only zeros and ones), it is 4×4 so it is a square matrix, it is a lower triangular matrix as it only has zeros above the leading diagonal and it is a regular matrix as it has an inverse. It is not symmetric because $F^T \neq F$.

Question 3 Answer C

A matrix will **not** have an inverse if the determinant is equal to zero.

Determinant $= 72 - ab$

$72 - ab = 0$ if $ab = 72$

All the distractors have products that are equal to 72 except C where $-8 \times 9 = -72$.

Question 4 Answer B

The lower triangle would be the opposite of the upper triangle.

If A beat B there is a 1, which in turns means that B loses to A so there is a zero.

$$\begin{array}{cc} & \begin{matrix} G & H & I & J & K \end{matrix} \\ \begin{matrix} \\ \\ winner \\ \\ \\ \end{matrix} & \begin{matrix} G \\ H \\ I \\ J \\ K \end{matrix} \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 \end{bmatrix} \end{array} \quad loser$$

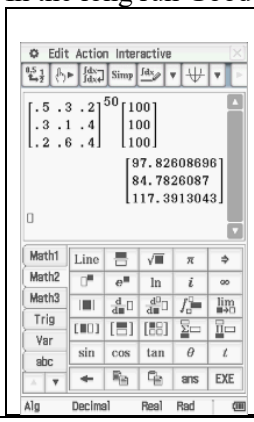
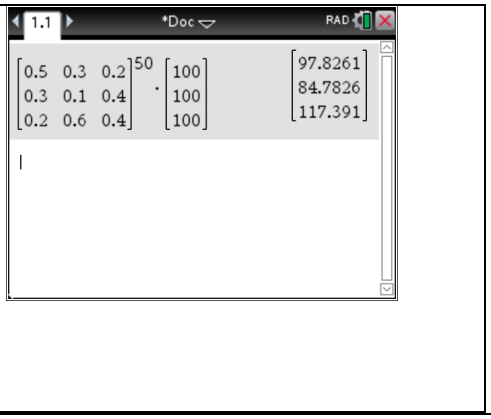
Question 5 Answer B

It is important that the matrix is read the correct way.

$$\begin{array}{c} this\ week \\ \begin{matrix} A & B & C \end{matrix} \\ \begin{bmatrix} 0.56 & 0.51 & 0.12 \\ 0.32 & 0.26 & 0.34 \\ 0.12 & 0.23 & 0.54 \end{bmatrix} \end{array} \begin{matrix} A \\ B \\ C \end{matrix} \quad next\ week$$

The proportion that moves from A to B is 0.32, A to C is 0.12 … etc.

Question 6 Answer E

A. Although the proportion of the people is the same, the actual number of people who change will depend on the number people there were before the transition.	False
B. In the long run Good Life will have the most customers.  	False
C. Each time 60% of Flavours' customers will change to Good Life.	False
D. Although the proportions sum to 0.5, the total percentage of the people who will go to Edge is dependent on the number people there were before the transition.	False
E. 50% of the Edge customers stay at Edge and the other 50% will change with 30% going to Flavours and 20% going to Good Life.	True

Question 7 Answer C

$$\begin{bmatrix}0.7 & 0.2 & 0.1\\0.1 & 0.5 & 0.4\\0.2 & 0.3 & 0.5\end{bmatrix} \times A_2 + \begin{bmatrix}100\\200\\300\end{bmatrix} = \begin{bmatrix}1407\\1651\\1742\end{bmatrix}$$

$$\begin{bmatrix}0.7 & 0.2 & 0.1\\0.1 & 0.5 & 0.4\\0.2 & 0.3 & 0.5\end{bmatrix} \times A_2 = \begin{bmatrix}1307\\1451\\1442\end{bmatrix}$$

$$A_2 = \begin{bmatrix}0.7 & 0.2 & 0.1\\0.1 & 0.5 & 0.4\\0.2 & 0.3 & 0.5\end{bmatrix}^{-1} \begin{bmatrix}1307\\1451\\1442\end{bmatrix}$$

$$A_2 = \begin{bmatrix}1240\\1430\\1530\end{bmatrix}$$

$$\begin{bmatrix}0.7 & 0.2 & 0.1\\0.1 & 0.5 & 0.4\\0.2 & 0.3 & 0.5\end{bmatrix} \times A_1 + \begin{bmatrix}100\\200\\300\end{bmatrix} = \begin{bmatrix}1240\\1430\\1530\end{bmatrix}$$

$$\begin{bmatrix}0.7 & 0.2 & 0.1\\0.1 & 0.5 & 0.4\\0.2 & 0.3 & 0.5\end{bmatrix} \times A_1 = \begin{bmatrix}1140\\1230\\1230\end{bmatrix}$$

$$A_1 = \begin{bmatrix}0.7 & 0.2 & 0.1\\0.1 & 0.5 & 0.4\\0.2 & 0.3 & 0.5\end{bmatrix}^{-1} \begin{bmatrix}1140\\1230\\1230\end{bmatrix}$$

$$A_1 = \begin{bmatrix}1100\\1200\\1300\end{bmatrix}$$

Question 8 Answer C

The wholesale price for SUVs is $20 000 each and for utes is $30 000 each. He buys vehicles at a wholesale price and then adds 25% to the SUV wholesale price and 15% to the ute wholesale price to determine the selling price.

This can be calculated using the matrix multiplication $\begin{bmatrix} 1.25 & 0 \\ 0 & 1.15 \end{bmatrix}\begin{bmatrix} 20000 \\ 30000 \end{bmatrix}$

He then adds $500 in registration and fees to every vehicle to determine the drive-away price.

$$\begin{bmatrix} 1.25 & 0 \\ 0 & 1.15 \end{bmatrix}\begin{bmatrix} 20000 \\ 30000 \end{bmatrix} + \begin{bmatrix} 500 \\ 500 \end{bmatrix}$$

In January, the dealer sells 12 SUVs and 9 utes. In February, the dealer sells 17 SUVs and 11 utes.

In March, the dealer sells 14 SUVs and 10 utes.

This can be displayed in 3×2 matrix $\begin{bmatrix} 12 & 9 \\ 17 & 11 \\ 14 & 10 \end{bmatrix}$

Pre-multiplying we get the sales for each month.

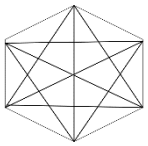
$$\begin{bmatrix} 12 & 9 \\ 17 & 11 \\ 14 & 10 \end{bmatrix}\left(\begin{bmatrix} 1.25 & 0 \\ 0 & 1.15 \end{bmatrix}\begin{bmatrix} 20000 \\ 30000 \end{bmatrix} + \begin{bmatrix} 500 \\ 500 \end{bmatrix}\right) = \begin{bmatrix} 621000 \\ 818500 \\ 707000 \end{bmatrix}$$

Premultiplying again with a summing row matrix we get the total of all sales.

$$\begin{bmatrix} 1 & 1 & 1 \end{bmatrix}\begin{bmatrix} 621000 \\ 818500 \\ 707000 \end{bmatrix} = [2146500]$$

Module 2: Networks and decision mathematics

Question 1 Answer D



A complete graph has $\frac{n(n-1)}{2}$ edges.

A complete graph with six vertices has $\frac{6\times5}{2} = 15$ edges

Question 2 Answer A

The roads have a loop from C so we can eliminate the distractors D and C.

There are two distinct routes from C to B, two from A to B and three from C to A which eliminates distractors B and E.

So the answer is A.

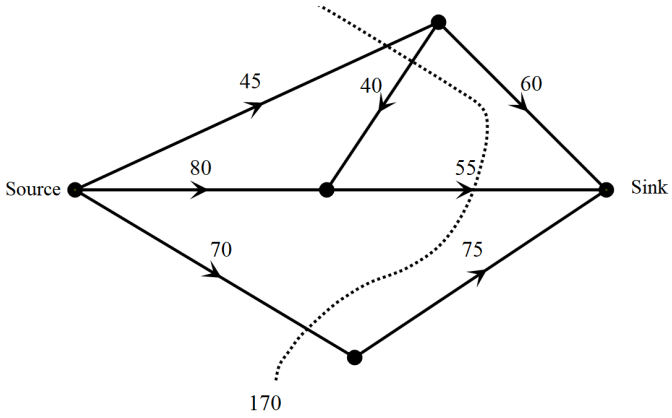
Question 3 Answer D

$v + f = e + 2$

$8 + 6 = e + 2$ so $e = 12$

Question 4 Answer B

Minimum cut is shown below and has a capacity of $45 + 55 + 70 = 170$ (the 40 edge is in the opposite direction to the flow and is not counted towards the cut capacity).



Question 5 Answer D

Insert a large number in for the unacceptable match and apply the Hungarian algorithm

	Process 1	Process 2	Process 3	Process 4
Alice	23	18	12	18
Bjorn	28	24	17	26
Charlotte	17	20	100	23
David	15	23	19	27

Subtract the lowest number from each row

	Process 1	Process 2	Process 3	Process 4
Alice	11	6	0	6
Bjorn	11	7	0	9
Charlotte	0	3	83	6
David	0	8	4	12

Subtract the lowest number from each column

	Process 1	Process 2	Process 3	Process 4
Alice	11	3	0	0
Bjorn	11	4	0	3
Charlotte	0	0	83	0
David	0	5	4	6

Check that the zeros can be covered by four lines – this can be done.
So allocation can be done

	Process 1	Process 2	Process 3	Process 4
Alice	11	3	0	0
Bjorn	11	4	0	3
Charlotte	0	0	83	0
David	0	5	4	6

Alice to do Process 4	18
Bjorn to do Process 3	17
Charlotte to do Process 2	20
David to do Process 1	15
Total time is	70

Question 6 Answer D

The earliest start time for activity F is the longest path from the start to the beginning of activity F.

This is the path BC with a length of 10 hours.

The critical path for this network is BCDEI with a length of 20 hours.

The longest path from the start of F is the end is FH with a length of 7 hours, so because the project must be completed by 20 hours the latest start time is 20 – 7 = 13 hours.

Question 7 Answer E

The critical path is BCDEI

Reducing A by three hours will have no effect as A is not on the critical path.
Increasing I or B will increase the time but will not create a new critical path.
Reducing C by one hour will not be enough to change the path as A has a float time of 2 hours
Reducing E by three hours will change the critical path to BCFGI or BCFH

Question 8 Answer C

Activity C has an immediate predecessor of activity A which eliminates distractor A.
Activity G does not have F as an immediate predecessor which eliminates distractor B.
Activity D does not have G as a immediate predecessor which eliminates distractor D.
Activity G does not have C as a immediate predecessor which eliminates distractor E

Module 3: Geometry and Measurement

Question 1 Answer C

$x° = 53° + 63° = 116°$

Question 2 Answer A

A.	75ºN 33ºE	10 degrees East
B.	75ºN 10ºE	13 degrees West
C.	85ºN 33ºE	10 degrees North and 10 degrees East
D.	85ºN 23ºE	10 degrees North
E.	75ºS 23ºE	150 degree South

The 75º latitude is a shorter circle than the 23º longitude circle.

Question 3 Answer E

Paul flies from 4ºW to 94ºW so 90 degrees west to Kansas City along the 40ºN parallel of latitude.

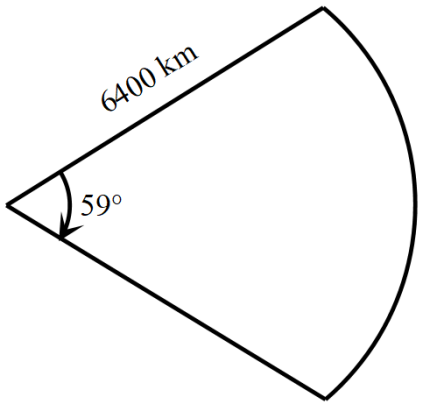
$90 \div 15 = 6$ so Paul crosses 6 hours of time zones.

When he arrives in Kansas City it will be 2am Thursday in Madrid as the flight takes 9 hours.

It will be six hours earlier in Kansas City or 8pm Wednesday

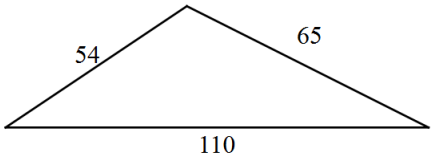
Question 4 Answer D

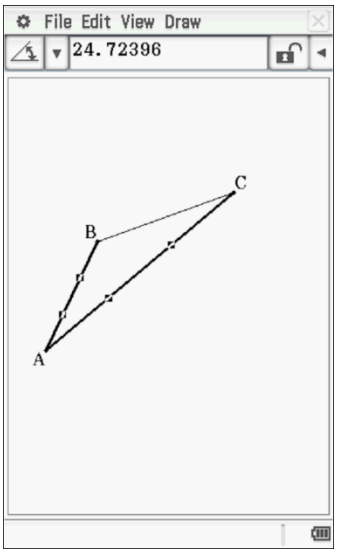
There are 59 degrees along a great circle (34 + 25 = 59º) between the two locations:



$\frac{59}{360} \times 2 \times \pi \times 6400 = 6590.363256$ which is closest to 6590 km.

Question 5 Answer B



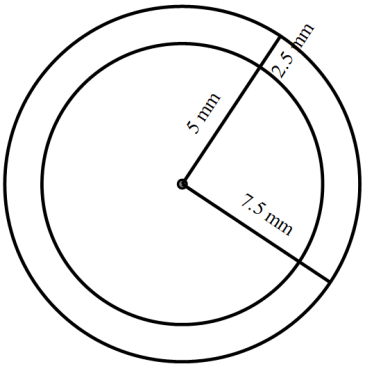


$$cosA = \frac{b^2+c^2-a^2}{2bc}$$

$$cosA = \frac{54^2+110^2-65^2}{2(54)(110)}$$

$$A = 24.7°$$

Question 6 Answer A

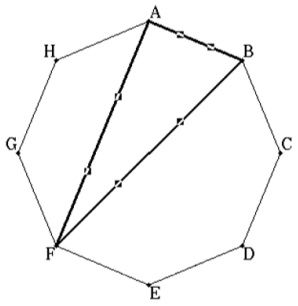


Convert all the units into centimetres, so the outer radius is 7.5 mm = 0.75 cm and the thickness of the hose is 2.5 mm = 0.25 cm. The inner radius of pipe is therefore (0.75 – 0.25) cm

Cross sectional area $= \pi\ (0.75 - 0.25)^2 = 0.785398$ ...

Volume $= 0.785398\ \times 3000 = 2356.19\ cm^3 = 2.36L$

Question 7 Answer D

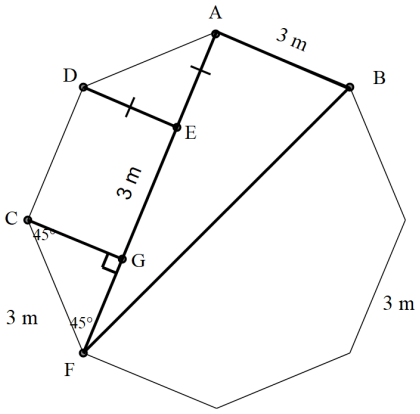


The interior angles in an octagon are $(180 - \frac{360}{8}) = 135°$. This can be used to determine that the triangle ABF is right angled (shown below). The three sides shown above can be calculated as follows:

Side AB is 3 metres as it is one side of the regular octagon.

Side AF:

Using geometry the following can be determined:



The length AF is made up of AE + EG + GF. EG is 3 m because it is parallel to CD. The two sections AE and GF are equal and each form one side of a right angled isosceles triangle with a hypotenuse of 3 m. The lengths AE and GF are determined as follows:

$x^2 + x^2 = 3^2$

$x = 2.12132 \ldots m$

So AF is $3 + 2 \times 2.12132 = 7.242640688 \ldots m$

Side FB:

Triangle AFB is right angled. This is because the internal angle of the octagon is 135º, and angle DAE is 45º so angle FAB is 135º − 45º = 90º so use Pythagoras' theorem:

$FB^2 = 7.2426 \ldots^2 + 3^2$

$FB = 7.8393777 \ldots$

Total is $3 + 7.2426 \ldots + 7.8393 \ldots = 18.08\, m$

Question 8 Answer E

There are 4 balls each with a radius half of the previous one. So the radii are in the ratio $1:\frac{1}{2}:\frac{1}{4}:\frac{1}{8}$.

The volume of each ball is the cube of the radius so the volume ratio is

$$1^3:\left(\frac{1}{2}\right)^3:\left(\frac{1}{4}\right)^3:\left(\frac{1}{8}\right)^3 = 1:\frac{1}{8}:\frac{1}{64}:\frac{1}{512}$$

Therefore the volume not taken up would be $1-\frac{1}{8}-\frac{1}{64}-\frac{1}{512}=\frac{439}{512}$.

Another way is to allocate a value for the volume of the larger ball:

Let the volume of the ball be 512 units.

Volume of the larger inner ball is 64 units

Volume of the middle inner ball is 8 units.

Volume of the smaller inner ball is 1 units.

$\frac{512-64-8-1}{512}=\frac{439}{512}$

Module 4: Graphs and Relations

Question 1 Answer D

Horizontal line $y = -2$

Question 2 Answer A

The cheapest option is \$280.

A. One person carries 30kg and the other carries 10kg	$200 + 80 = 280$
B. One person carries 28kg and the other carries 12kg	$200 + 100 = 300$
C. One person carries 25kg and the other carries 15kg	$200 + 100 = 300$
D. One person carries 24kg and the other carries 16kg	$180 + 120 = 300$
E. Each person carries 20 kg	$180 + 180 = 360$

Question 3 Answer C

$1600 + \frac{2.5}{100} \times sales = 8400$

$Sales = \$272\,000$

Question 4 Answer D

The shape of the graph indicates D or E

The answer is D because the value of k is constant as shown below:

$$Pressure = \frac{k}{Volume}$$

$$k = Pressure \times Volume$$

$k = 60 \times 20 = 1200$

$k = 20 \times 60 = 1200$

Question 5 Answer E

$2.4n + 425 = 4.5n$

$n = 202.3809$

Must sell more than 202.3809 so 203

Question 6 Answer C

The lines are

- $x = 2$
- $y = \frac{3}{2}x$ (passes through (0, 0) and (2. 3))
- $y = 8$
- $y = 12 - \frac{3}{2}x$ (passes through (0. 12) and (8,0))

Points of intersection and values of Z where $Z = x + y$ are

(2,3) $Z = 2 + 3 = 5$

(2,8) $Z = 2 + 8 = 10$

(4,6) $Z = 4 + 6 = 10$

$(\frac{8}{3}, 8)$ $Z = \frac{8}{3} + 8 = 10\ \frac{2}{3} = \frac{32}{3}$

Question 7 Answer A

All the points meet the requirement $y \leq 6$.

		$8x + 5y \leq 40$	$y \geq 2x + 1$
A.	(2, 5)	False $8 \times 2 + 5 \times 5 = 41$	True $5 \geq 2 \times 2 + 1$
B.	(1, 6)	True $8 \times 1 + 5 \times 6 = 38$	True $6 \geq 2 \times 1 + 1$
C.	(1, 5)	True $8 \times 1 + 5 \times 5 = 33$	True $5 \geq 2 \times 1 + 1$
D.	(1, 4)	True $8 \times 1 + 5 \times 4 = 28$	True $4 \geq 2 \times 1 + 1$
E.	(0, 6)	True $8 \times 0 + 5 \times 6 = 30$	True $5 \geq 2 \times 0 + 6$

Question 8 Answer C

	X	Y	Total
Chromium	0.3	0.1	0.18
Nickel	0.1	0.2	0.16

$0.3x + 0.1y = 0.18$
$0.1x + 0.2y = 0.16$ $x = 0.4$ or 40% and $y = 0.6$ or 60%

All the combinations add to 100 tonnes therefore a combination where x is larger or equal to 40 and y is larger or equal to 60 needs to be identified– C is 40%x and 60%y

END OF SOLUTIONS