Neap:

Trial Examination 2010

VCE Further Mathematics Units 3 & 4

Written Examination 1

Multiple-choice Question Booklet

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

Section	Number of questions	Number of questions to be answered	Number of modules	Number of modules to be answered	Marks
A – Core	13	13			13
B – Modules	54	27	6	3	27
					Total 40

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved graphics calculator or approved CAS calculator or CAS software and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared.
Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white-out liquid/tape.

Materials supplied

Question booklet of 32 pages with a detachable sheet of miscellaneous formulas in the centrefold.
Answer sheet for multiple-choice questions.
Working space is provided throughout the booklet.

Instructions

Detach the formula sheet from the centre of this booklet during reading time.
Please ensure that you write your **name** and your **teacher's name** in the space provided on this page and on the answer sheet for multiple-choice questions.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2010 VCE Further Mathematics Units 3 & 4 Written Examination 1.

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SECTION A

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No mark will be given if more than one answer is completed for any question.

Core: Data analysis

Question 1

Which of the following measurements would you use to best describe the centre and spread of the following data set?

1, 1, 1, 2, 2, 3, 4, 5, 8, 12, 14, 15, 17, 18, 194

A. median and range
B. median and standard deviation
C. mean and IQR
D. mode and standard deviation
E. median and IQR

Question 2

Statistics recorded on the diameter of the first 20 bolts produced by two different machines are summarised in the following back-to-back stem plot.

Machine *A*	Stem	Machine *B*
4 4 4 3 3 2	9	1 2 3 3 4
9 8 7 6 6	9*	5 6 7 7 8 9 9
4 3 1 1 0	10	0 0 2 4 4 4 4
8 8 6 5	10*	5

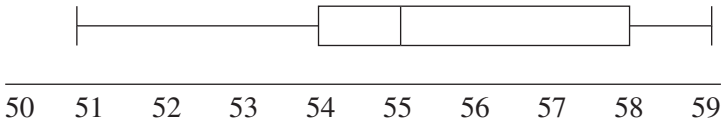
(10*)/7 = 10.7 mm

Which of the following statements is completely true?

A. The range and IQR of *A* is 16 and 9.5.
B. The median of both sets of data is 9.85.
C. The mode of *B* is 9.3.
D. The range of both sets of data is 1.6.
E. The range of *B* is 1.4 and the IQR is 10.4.

Question 3

The box plot below represents which set of data?



A. 51, 54, 55, 55, 58, 59, 59
B. 51, 54, 54, 54, 55, 57, 58, 58, 59
C. 51, 52, 54, 54, 55, 57, 58, 58, 59
D. 50, 54, 54, 54, 55, 57, 58, 58, 59
E. 51, 52, 53, 54, 55, 56, 57, 58

Question 4

The number of match sticks contained in 40 boxes is recorded in the table below.

Number of match sticks	Frequency
47	3
48	8
49	10
50	12
51	6
52	1

Which of the following statements is true about the data?

A. The median is 49.5 and the IQR is 2.
B. The range is 11 and the IQR is 7.
C. The mode is 50 and the IQR is 2.
D. The range is 5 and the mode is 12.
E. The mean is 49.5.

Question 5

In an experiment with a set volume of food, the relationship between the number of insects and the mass of remaining food is found to have a correlation of –0.4.

Which of the following is true?

A. 40% of the food has been eaten by the insects.
B. 16% of the food has been eaten by the insects.
C. Increasing the amount of food increases the number of insects.
D. Increasing the number of insects decreases the amount of food.
E. 60% of the change in number of insects is due to random factors.

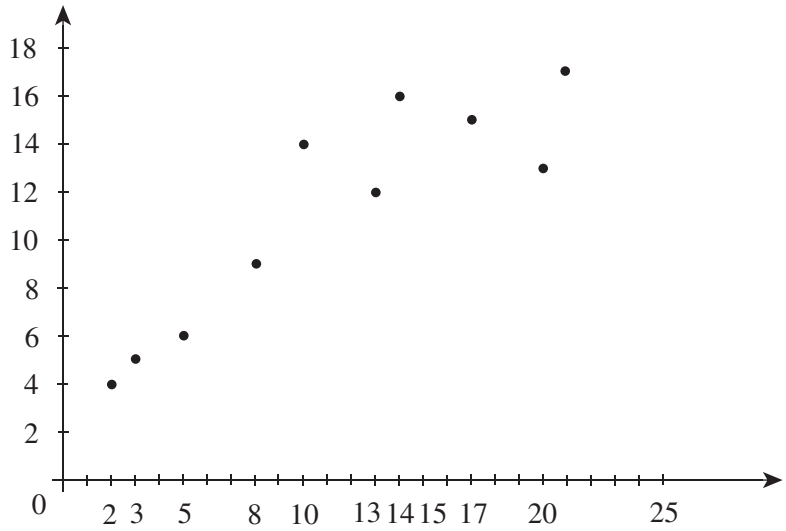
Question 6

In peak hour traffic, the number of vehicles passing through an intersection is found to be normally distributed with a mean of 250 per hour and a standard deviation of 20.

The percentage of time for which there is less than 270 vehicles per hour is closest to

A. 27%
B. 34%
C. 68%
D. 84%
E. 86%

Question 7



The gradient of the three median regression line for the above graph is closest to

A. $\frac{8}{17}$

B. $\frac{10}{17}$

C. $\frac{10}{15}$

D. $\frac{8}{15}$

E. $\frac{13}{19}$

Question 8

Which type of pattern would you expect if you plotted a time series for the depth of snow at Falls Creek?

A. increasing trend
B. decreasing trend
C. cyclical
D. seasonal
E. random

The following data applies to Questions 9 and 10.

The sales results for Rashid's car yard over eight consecutive quarters are:

	Q_1	Q_2	Q_3	Q_4	**Yearly average**
2008	42 000	21 000	15 000	22 000	25 000
2009	52 000	32 000	26 000	50 000	40 000

Question 9

The seasonal index for the first quarter is

A. 1.3
B. 1.49
C. 1.68
D. 47 000
E. 94 000

Question 10

The seasonal index for Q_2 is 0.82.

The deseasonalised figure to the nearest 10 of Q_2 in 2009 is

A. 17 220
B. 25 610
C. 26 240
D. 39 020
E. 64 630

The following information applies to Questions 11, 12 and 13.

After analysing the data for the hours worked and the volume of production in the table below, the regression equation is: production (kg) = 763 + 49 × hours worked .

Hours worked	18	38	50	42	24	35	40
Production (kg)	2000	2500	3200	3000	1500	2400	2800

Question 11

Using this equation, the expected production when 30 hours are worked is closest to

A. 910
B. 1470
C. 1500
D. 2230
E. 2233

Question 12

When this equation is used to predict the volume after 35 hours work, the residual is closest to

A. –78
B. –0.78
C. 0
D. 0.78
E. 79

Question 13

After performing a log(x) transformation, the equation of the line of best fit is closest to

A. production (kg) = $-2553 + 3302 \times \log(\text{hours worked})$

B. production (kg) = $-2553 + 3302 \times$ hours worked

C. production (kg) = $2553 + 3302 \times \log(\text{hours worked})$

D. production (kg) = $\log 2553 + 3302 \times \log(\text{hours worked})$

E. production (kg) = $\log 2553 + 3302 \times$ hours worked

END OF SECTION A

SECTION B

Instructions for Section B

Select **three** modules and answer **all** questions within the modules selected in pencil on the answer sheet provided for multiple-choice questions.

Show the modules you are answering by shading the matching boxes on your multiple-choice answer sheet.

Choose the response that is **correct** for the question.

A correct answer scores 1, an incorrect answer scores 0.

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Module **Page**

Module 1: Number patterns

Before answering these questions you must **shade** the "Number patterns" box on the answer sheet for multiple-choice questions.

Question 1

The geometric sequence starting with the numbers 3, 6 and 12 would take n terms to exceed 1000 where n is

A. 7
B. 8
C. 9
D. 9.3808
E. 10

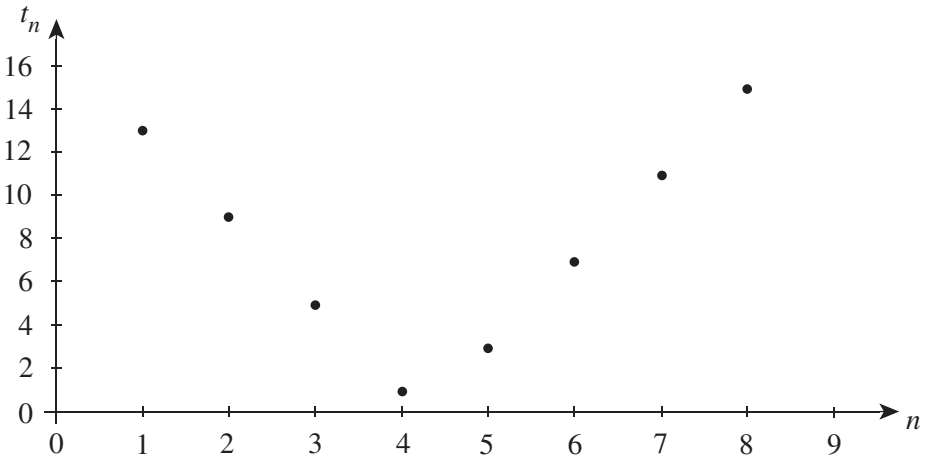
Question 2

For the sequence of numbers 16, –8, 4, –2, … , the sum of an infinite number of terms would be

A. undefined
B. 0
C. 10
D. $10\frac{2}{3}$
E. 32

Question 3

The graph below shows the terms of a sequence.



The sequence is most likely to be

A. arithmetic with a positive common difference.
B. arithmetic with a negative common difference.
C. geometric with a positive common ratio.
D. geometric with a negative common ratio.
E. neither arithmetic nor geometric.

Question 4

For a certain arithmetic sequence, the first term is 20 and the fifth term is 0.

The sum of these 5 terms is

A. –4
B. 20
C. 50
D. 70
E. 100

Question 5

Miriam has a $400 debt. Every month she is charged 5% interest on this and she then repays $50 of the debt.

A difference equation that calculates the total debt would be

A. $t_{n+1} = 0.05t_n - 50, \quad t_1 = 400$

B. $t_{n+1} = 0.05(t_n - 50), \quad t_1 = 400$

C. $t_{n+1} = 1.05t_n - 50, \quad t_1 = 400$

D. $t_{n+1} = 1.05(t_n - 50), \quad t_1 = 400$

E. $t_{n+1} = 1.5(t_n - 50), \quad t_1 = 400$

Question 6

A certain arithmetic sequence has first term 27. The sum of the first 5 terms is 25.

The second term is

A. –11
B. 11
C. 16
D. 26
E. 38

Question 7

Amy has a system of investing money in any given month. It involves taking the sum of the two preceding months and reducing this figure by 40% to obtain the new month's figure. In March $1280 was invested while in April $1620 was invested.

The amount invested in May will be

A. $1160 and decreasing thereafter.
B. $1740 and settling into an increasing trend.
C. $1740 and decreasing thereafter.
D. $1160 but neither increasing nor decreasing every month thereafter.
E. $2900.

Question 8

The sum of the first six terms of a certain non-zero geometric sequence is zero.

From this we know that

A. the common ratio is –1.
B. the common ratio is zero.
C. the common ratio is 1.
D. one of the terms is zero.
E. the common ratio is either 1 or –1.

Question 9

The fourth term of the sequence given by $t_{n+2} = 3t_n - t_{n+1}$, $t_1 = 2$, $t_2 = 5$ is

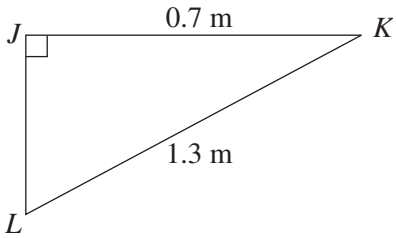
A. 1
B. 11
C. 13
D. 14
E. 34

END OF MODULE 1

Module 2: Geometry and trigonometry

Before answering these questions you must **shade** the "Geometry and trigonometry" box on the answer sheet for multiple-choice questions.

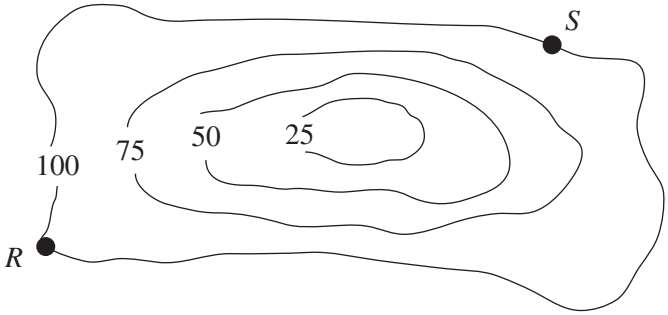
Question 1



For the right-angled triangle *JLK*, the size of angle *JLK* is closest to

A. 28°
B. 33°
C. 47°
D. 52°
E. 57°

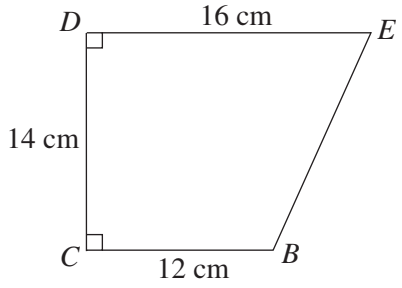
Question 2



The difference in height between point *R* and point *S* in the above contour map is

A. 0 m
B. 25 m
C. 50 m
D. 75 m
E. 100 m

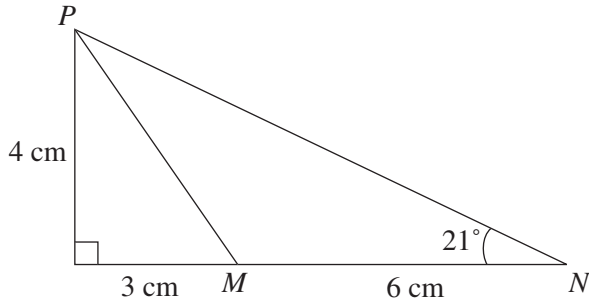
Question 3



The perimeter of trapezium *BCDE* above is closest to

A. 16 cm
B. 57 cm
C. 61 cm
D. 65 cm
E. 196 cm

Question 4



For the diagram shown above, angle *MPN* is closest to

A. 21°
B. 22°
C. 23°
D. 24°
E. 25°

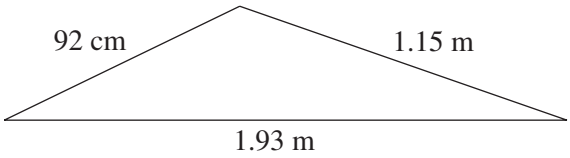
Question 5

A competitor in an orienteering competition runs due West from the starting point for 135 metres. She then runs due South for 135 metres, and then runs due West for 135 metres, to reach checkpoint *A*.

The true bearing of the starting point from checkpoint *A* is closest to

A. 53°
B. 63°
C. 135°
D. 243°
E. 270°

Question 6



Heron's formula, Area = $\sqrt{s(s-a)(s-b)(s-c)}$, is used to calculate the area of the triangle shown above.

A possible value for s is

A. $\frac{4}{3}$

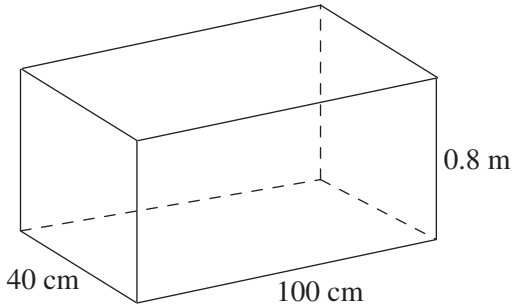
B. 4

C. 100

D. 200

E. 400

Question 7



The total surface area of the rectangluar prism shown above can be found by calculating

A. $2 \times 0.4 + 2 \times 0.4 \times 0.8 + 2 \times 0.8$

B. $2 \times 0.4 \times 100 + 2 \times 0.4 \times 0.8 + 2 \times 0.8 \times 100$

C. $2 \times 40 \times 100 + 2 \times 40 \times 0.8 + 2 \times 80 \times 100$

D. $2 \times (40 \times 100 + 40 \times 80 + 0.8 \times 100)$

E. $2 \times (0.4 \times 1.0 + 0.4 \times 80 + 0.8 \times 1)$

Question 8

A rectangular prism has a square end with an area of 81 cm^2. The length of the prism is twice the height of the prism. The prism is to contain a thin straight pipe.

The longest pipe that could be placed in the prism has a length that is closest to

A. 9 cm

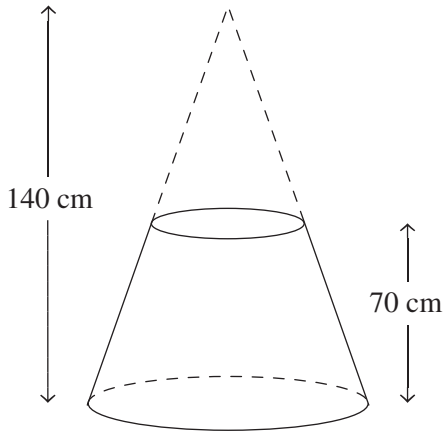
B. 13 cm

C. 18 cm

D. 22 cm

E. 36 cm

Question 9



An inverted cone is modified and then used as a supermarket display stand. The top section of the cone has been removed to create a flat platform (in the shape of a circle). When the top section of the cone is removed, the stand is 70 cm tall. The original cone was 140 cm tall.

The fraction of the volume of the original cone that remains after the removal of the top section is

A. $\frac{1}{8}$

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. $\frac{3}{4}$

E. $\frac{7}{8}$

END OF MODULE 2

Module 3: Graphs and relations

Before answering these questions you must **shade** the "Graphs and relations" box on the answer sheet for multiple-choice questions.

Question 1

The line joining the points $P(3, -1)$ and $Q(-6, 5)$ would have the equation

A. $y = \frac{2}{3}x + 1$

B. $y = \frac{2}{3}x - 3$

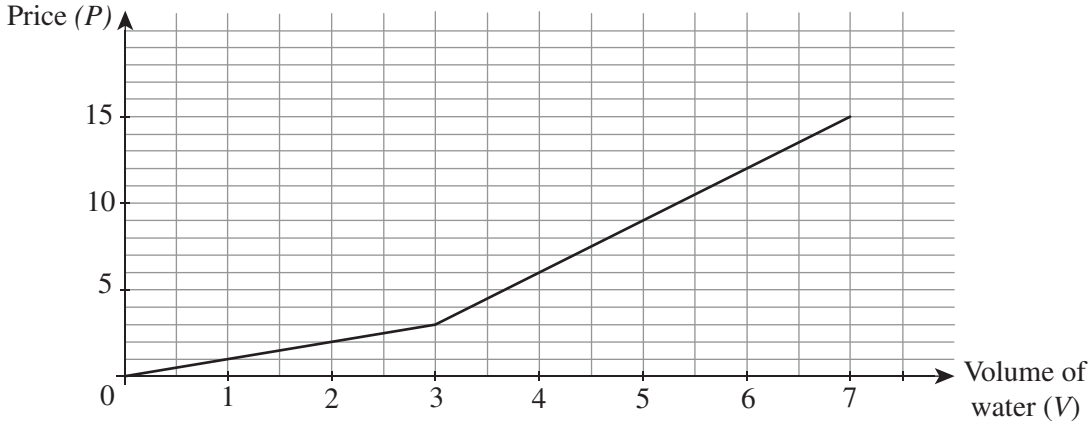
C. $y = 1 - \frac{3}{2}x$

D. $3x + 2y = 3$

E. $2x + 3y = 3$

Question 2

The graph below shows the price of water usage charged by Danube Valley Water.



Which of the following rules could be used to describe the graph above?

A. $P = \begin{cases} V & \text{for } 0 \leq V \leq 3 \\ 3V - 6 & \text{for } V > 3 \end{cases}$

B. $P = \begin{cases} V & \text{for } 0 \leq V \leq 3 \\ 3V & \text{for } V > 3 \end{cases}$

C. $P = \begin{cases} V & \text{for } 0 \leq V \leq 3 \\ 3V + 3 & \text{for } V > 3 \end{cases}$

D. $P = \begin{cases} 3V & \text{for } 0 \leq V \leq 3 \\ V & \text{for } V > 3 \end{cases}$

E. $P = \begin{cases} V & \text{for } 0 \leq V \leq 3 \\ 2V - 3 & \text{for } V > 3 \end{cases}$

Question 3

The solutions of the simultaneous equations $2x + 5y = 8$ and $4x + 3y = 2$, are closest to

A. $(-1.42, 2.571)$

B. $(-1, 2)$

C. $(1.5, 1)$

D. $(4, 0)$

E. $(1.5, -1.333)$

Question 4

Khai runs an online newspaper. She pays $20 per page for the webspace and sells ads worth $200 per page. Khai has, however, overheads of $2000 per month, and she wants to find the number of pages, x, that must be produced to break even.

x can be determined from the solution of the equation

A. $20x = 2000$

B. $200x = 2000 - 20x$

C. $200x = 2000 + 20x$

D. $20x = 2000 - 200x$

E. $200x = -2000 + 20x$

Question 5

x	2	4	6	8
y	60	30	20	15

The data in the above table would best be plotted as a linear graph by plotting y against

A. x

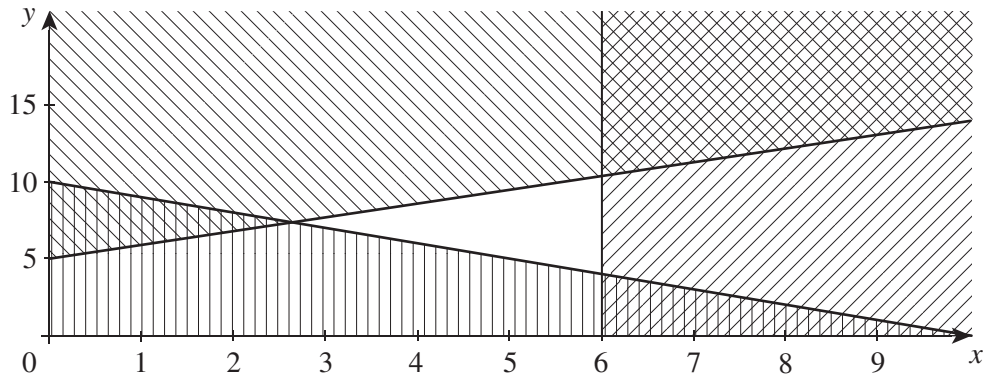
B. x^2

C. x^3

D. $\frac{1}{x}$

E. $\frac{1}{x^2}$

Question 6



The required region in the above graph is the unshaded section.

Which of the following is one of the inequations forming this region?

A. $y \geq 5 + x$

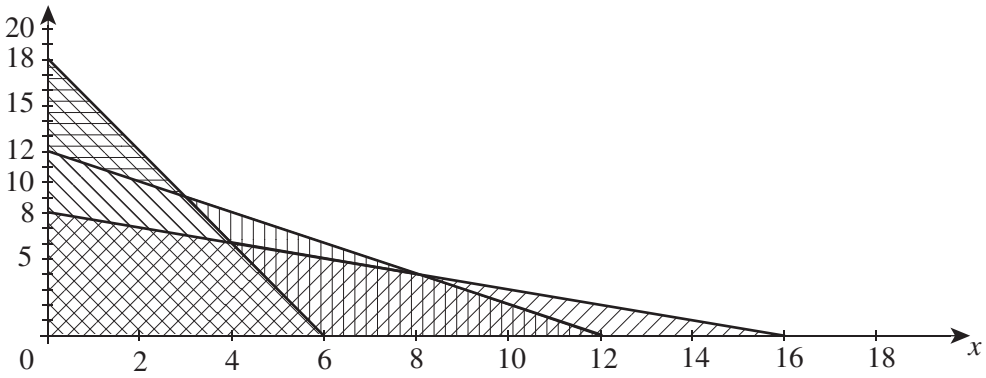
B. $x - y \geq -5$

C. $x \geq 6$

D. $x - y \leq -5$

E. $x + y \leq 10$

Question 7



The minimum value of the function $C = 4x + 3y$ in the unshaded region shown above is

A. 7

B. 34

C. 39

D. 44

E. 54

Question 8

The composition of two different types of food supplements, P and Q are shown in the table below.

Food supplement	Units of protein (per kg)	Units of vitamins (per kg)
P	20	20
Q	30	5

In addition to this, it is necessary to purchase more of P than Q. One decides to purchase x kg of P and y kg of Q. It is required that users should receive at least 100 units of vitamins per week, and a minimum of 120 units of protein.

Thus the applicable constraints are

A. $20x + 20y \geq 120$
$30x + 5y \geq 100$
$y \leq x$

B. $20x + 30y \geq 120$
$20x + 5y \geq 100$
$y \leq x$

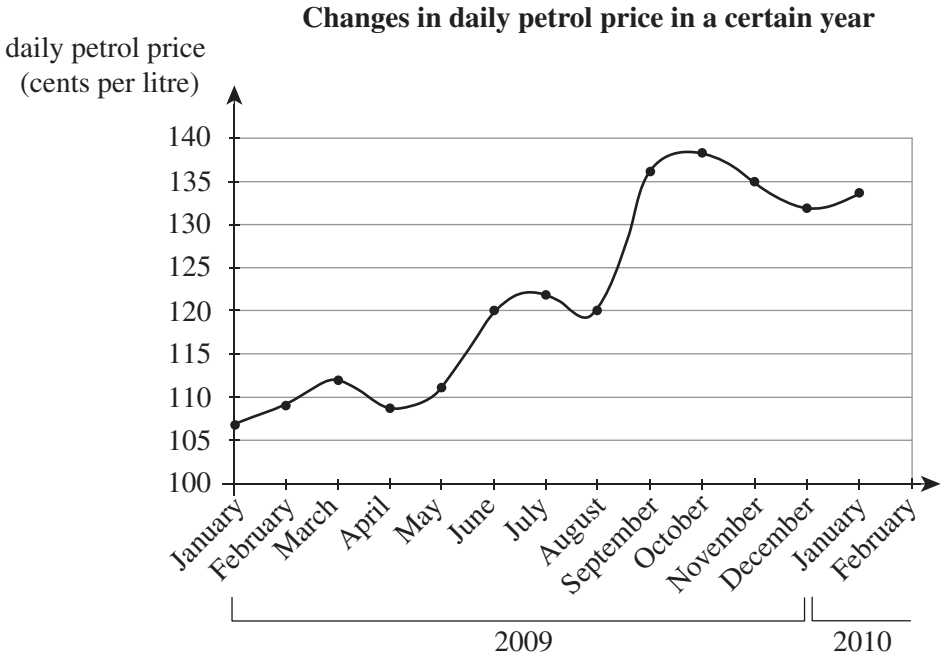
C. $20x + 20y \leq 120$
$30x + 5y \geq 100$
$y \geq x$

D. $20x + 30y \geq 120$
$20x + 5y \leq 100$
$y \geq x$

E. $20x + 20y \leq 120$
$30x + 5y \geq 100$
$x + y \geq 0$

Question 9

The graph below shows the changes in daily petrol price in a certain year. The points on the graph refer to the first of each month.



The month during which the petrol price changed most rapidly was

A. April
B. May
C. July
D. August
E. September

END OF MODULE 3

Module 4: Business-related mathematics

Before answering these questions you must **shade** the "Business-related mathematics" box on the answer sheet for multiple-choice questions.

Question 1

The *Discounts R Us* store wants to make a 15% profit on all items they sell.

If they buy t-shirts for $18.00, the selling price will be closest to

A. $2.70
B. $15.30
C. $15.65
D. $20.70
E. $21.20

Question 2

Sonya loans her friend $15 000 to buy a new car. They agree that a flat 10% per annum interest with the loan will be repaid in full over three years by equal monthly repayments.

Each monthly repayment is closest to

A. $416.67
B. $484.01
C. $541.67
D. $1625
E. $4500

Question 3

The balance sheet for Ryan's bank account for the month of March is shown below. The interest is calculated on the minimum monthly balance.

Date	Transaction	Debit ($)	Credit ($)	Balance ($)
1 March				480
15 March	withdrawal	200		
16 March	withdrawal	200		
23 March	deposit		500	
31 March	interest			

If the interest rate is 6.5% per annum the balance at the end of the month will be

A. $0.43
B. $5.20
C. $80
D. $580.43
E. $585.20

Question 4

A new refrigerator priced at $1280 is purchased on a hire-purchase agreement requiring a 20% deposit and 24 equal monthly repayments of $55.47.

The flat rate of interest is closest to

A. 2%
B. 4%
C. 12%
D. 15%
E. 30%

Question 5

A parcel of land was purchased ten years ago for $38 000. The average rate of inflation over those ten years has been 1.8%.

Assuming no other appreciation factors, the current value of the land is closest to

A. $6 840
B. $7 421.50
C. $38 684
D. $44 840
E. $45 421.50

Question 6

Nui invests $7500 at 5.6% per annum compounding monthly. She withdraws the investment when it reaches a value of approximately $9000.

To the nearest month, how long does she need to leave the investment?

A. 3 months
B. 4 months
C. 39 months
D. 40 months
E. 43 months

Question 7

A printing company purchases a new printer for $280 000 and it is expected to produce 10 000 000 copies before being scrapped at a value of $45 000.

The depreciation per copy is

A. 0.028 cents per copy.
B. 0.235 cents per copy.
C. 2.35 cents per copy.
D. 2.8 cents per copy.
E. 3.25 cents per copy.

Question 8

A loan of $24 000 is taken out at a rate of 8.2% per annum compounding monthly.

If no repayments are made, the amount owing after two and a half years is closest to

A. $4 920
B. $5 440
C. $24 412
D. $28 920
E. $29 440

Question 9

Alex takes out a $220 000 loan to buy an apartment. The interest rate is 7.2% per annum compounding monthly, with monthly repayments of $1868. After five years he decides to sell the apartment and buy a house.

The amount of money still owing on the loan is closest to

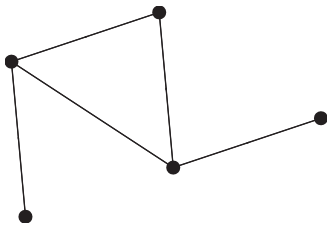
A. $107 200
B. $107 920
C. $112 080
D. $180 563
E. $187 120

END OF MODULE 4

Module 5: Networks and decision mathematics

Before answering these questions you must **shade** the "Networks and decision mathematics" box on the answer sheet for multiple-choice questions.

The following diagram relates to Questions 1 and 2.



Question 1

The number of vertices with an even degree in the network above is

A. 0
B. 1
C. 2
D. 3
E. 4

Question 2

One edge is added to the network above in such a way that one vertex has a degree of four.

After this edge is added, the sum of the degrees of every vertex in the network is

A. 5
B. 6
C. 10
D. 11
E. 12

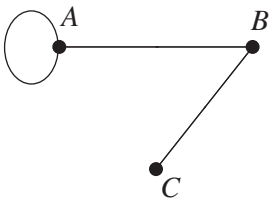
Question 3

$$\begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 4 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \end{array}$$

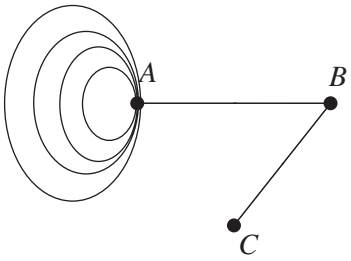
An adjacency matrix is shown above.

A network graph that represents the adjacency matrix is

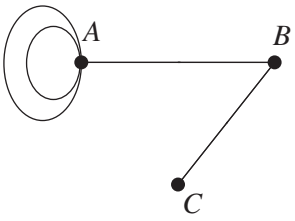
A.



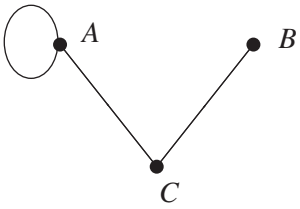
B.



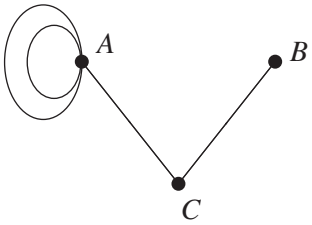
C.



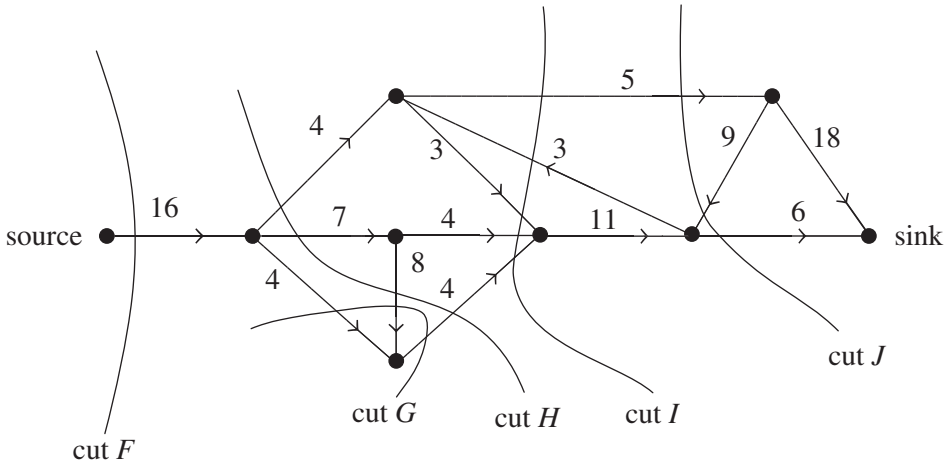
D.



E.



Question 4

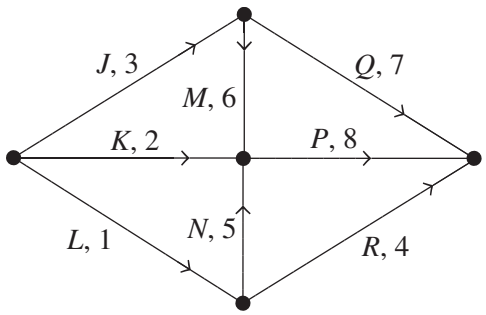


The graph above shows the values of the flow between vertices in a project. One of the five cuts shown above indicates the maximum flow from the source to the sink.

The cut which indicates the maximum flow is

A. cut *F*.
B. cut *G*.
C. cut *H*.
D. cut *I*.
E. cut *J*.

Question 5

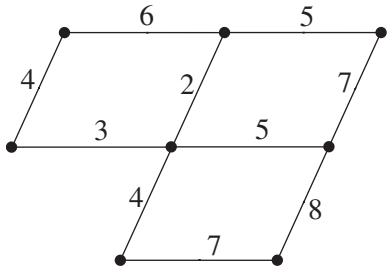


The activities and their duration, in hours, of a project are shown in the network above.

The float (slack) time of activity *R* is

A. 1 hour.
B. 4 hours.
C. 8 hours.
D. 12 hours.
E. 17 hours.

Question 6



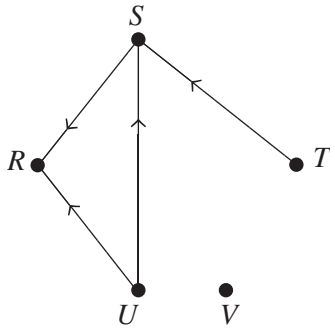
The minimal spanning tree for the network shown above will **not** include an edge that has a weight of

A. 3
B. 4
C. 5
D. 6
E. 7

The following information relates to Questions 7 and 8.

Question 7

Five players, *R*, *S*, *T*, *U* and *V* compete in a darts tournament. Each player will compete against every other player once in this tournament. One Player, Player *V*, has not played any games so far due to injury. The results of all games played part way through the tournament are shown in the directed graph below.



The number of edges (arrows) that will be added to the directed graph above to represent the completion of the tournament will be

A. 4
B. 5
C. 6
D. 8
E. 10

Question 8

At the end of the tournament some results had been lost. It is known that the results in the directed graph above are accurate, Player *T* won just one match in total and Player *V* lost to Player *U*. No other results are available.

The player who has the highest 2-step dominance at the end of the tournament is

A. Player *R*.
B. Player *S*.
C. Player *T*.
D. Player *U*.
E. Player *V*.

Question 9

A connected planar graph has three times as many edges as it has faces.

If there are 12 vertices in this graph, the number of faces must be

A. 5
B. 10
C. 15
D. 20
E. 25

END OF MODULE 5

Module 6: Matrices

Before answering these questions you must **shade** the "Matrices" box on the answer sheet for multiple-choice questions.

Question 1

The matrix addition $\begin{bmatrix} 3 & -1 \\ 2 & 1 \end{bmatrix} + \begin{bmatrix} -2 & 1 & -2 \\ 3 & 2 & 2 \end{bmatrix}$

A. is defined and has result $\begin{bmatrix} 1 & 0 & -3 \\ 5 & 3 & 2 \end{bmatrix}$.

B. is defined and has result $\begin{bmatrix} -9 & 1 \\ -1 & 4 \end{bmatrix}$.

C. is defined and has result $\begin{bmatrix} -9 & 1 & -8 \\ -1 & 4 & -2 \end{bmatrix}$.

D. is undefined since the column number of the left matrix does not match the row number of the right matrix.

E. is undefined as the matrices have a different order.

Question 2

For square matrices P and Q, the matrix addition $P + Q$ is defined.

Which of these is always true?

A. $PQ = QP;\ P + Q \neq Q + P$

B. $PQ = QP;\ P + Q = Q + P$

C. $PQ \neq QP;\ P + Q \neq Q + P$

D. $PQ \neq QP;\ P + Q = Q + P$

E. PQ, QP could be undefined

Question 3

The system of simultaneous equations

$$2x + 3y + z = 7$$
$$x + y = 3$$
$$2x - 3y - z = 1$$

can be solved by calculation of the product

A. $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 1 & 0 \\ 2 & -3 & -1 \end{bmatrix} \begin{bmatrix} 7 \\ 3 \\ 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & 1 \\ -1 & 4 & -1 \\ 5 & -12 & 1 \end{bmatrix} \begin{bmatrix} 7 \\ 3 \\ 1 \end{bmatrix}$

C. $\frac{1}{4}\begin{bmatrix} 1 & 0 & 1 \\ -1 & 4 & -1 \\ 5 & -12 & 1 \end{bmatrix} \begin{bmatrix} 7 \\ 3 \\ 1 \end{bmatrix}$

D. $\begin{bmatrix} 2 & 1 & 2 \\ 3 & 1 & -3 \\ 1 & 0 & -1 \end{bmatrix} \begin{bmatrix} 7 \\ 3 \\ 1 \end{bmatrix}$

E. $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 1 & 0 \\ 2 & -3 & -1 \end{bmatrix} \begin{bmatrix} 7 & 3 & 1 \end{bmatrix}$

Question 4

If $A = \begin{bmatrix} 2 & 4 \\ -1 & -2 \end{bmatrix}$, then A^{-1} is

A. defined as the inverse of A.
B. zero.
C. undefined as det(A) is also undefined.
D. singular.
E. undefined as A is singular.

Question 5

Due to an international agreement, the price on imported reading matter is reduced. The price of fiction falls by 18%, non-fiction 12%, and magazines 9%.

If current prices are in matrix format

$$P = \begin{bmatrix} f \\ n \\ m \end{bmatrix}$$

where f, n and m represent standard fiction, non-fiction and magazine prices, then the new prices would be

A. $Q + P$ where $Q = \begin{bmatrix} 0.18 \\ 0.12 \\ 0.09 \end{bmatrix}$

B. $Q + P$ where $Q = \begin{bmatrix} 0.83 \\ 0.88 \\ 0.91 \end{bmatrix}$

C. QP where $Q = \begin{bmatrix} 0.85 & 0 & 0 \\ 0 & 0.88 & 0 \\ 0 & 0 & 0.91 \end{bmatrix}$

D. QP where $Q = \begin{bmatrix} 0.18 & 0 & 0 \\ 0 & 0.12 & 0 \\ 0 & 0 & 0.09 \end{bmatrix}$

E. QP where $Q = \begin{bmatrix} 0.82 & 0.82 & 0.82 \\ 0.88 & 0.88 & 0.88 \\ 0.91 & 0.91 & 0.91 \end{bmatrix}$

Question 6

Points are allocated to teams contesting a cricket league as follows:

- 1 point for every 30 runs scored
- 1 point for every wicket taken
- 5 points for a first innings lead
- 10 points for a win

There are 5 teams in the tournament so a 4×5 matrix with one column for each team is produced. One row is allocated to each of the runs, wickets, first innings leads and wins in that order.

A matrix giving the points for each team would be achieved with

A. post-multiplying with $\begin{bmatrix} \frac{1}{30} \\ 1 \\ 5 \\ 10 \\ 0 \end{bmatrix}$.

B. pre-multiplying with $\begin{bmatrix} \frac{1}{30} \\ 1 \\ 5 \\ 10 \end{bmatrix}$.

C. post-multiplying with $\begin{bmatrix} \frac{1}{30} & 1 & 5 & 10 \end{bmatrix}$.

D. pre-multiplying with $\begin{bmatrix} \frac{1}{30} & 1 & 5 & 10 \end{bmatrix}$.

E. adding an appropriate matrix.

The following information relates to Questions 7 and 8.

The market share of fashion clothing designers *X*, *Y* and *Z,* are related to each other. The changes in each market share from one year to the next are given by the transition matrix

$$\begin{bmatrix} 0.80 & 0.20 & 0.10 \\ 0.15 & 0.75 & 0.10 \\ 0.05 & 0.05 & 0.80 \end{bmatrix} \text{ where } S_0 = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \text{ is the initial state.}$$

Question 7

It is true that the

A. market share of *X* decreases 20% per annum.
B. market share of *Y* is increased by 10% of that of *Z* every year.
C. market share of *Z* is increased by 10% of that of *Y* every year.
D. market share of *X* will be the largest of all three at all times.
E. market share of *Y* is likely to decrease over time.

Question 8

If the transition matrix above is used, then the correct conclusion to be drawn regarding possible steady states is that

A. $\begin{bmatrix} 0.450 \\ 0.350 \\ 0.200 \end{bmatrix}$ is the steady state.

B. $\begin{bmatrix} 0.80 \\ 0.15 \\ 0.05 \end{bmatrix}$ is the steady state.

C. $\begin{bmatrix} 0.675 \\ 0.2375 \\ 0.0875 \end{bmatrix}$ is the steady state.

D. steady state depends on initial state.
E. no steady state exists.

Question 9

Godfrey has the transition matrix $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$ that describes weekly poker match winnings among three players.

When he applies it to his initial state matrix S_0 (week 1 results) he notices that week 4 results are identical to week 1.

From this information he can correctly conclude that

A. a steady state has already been reached initially.
B. a steady state is reached over 4 weeks.
C. players seem to take it in turns to win.
D. over a period of 3 weeks all players may win unequal amounts.
E. week 5 will also be the same.

END OF MULTIPLE-CHOICE QUESTION BOOKLET

