Neap

Trial Examination 2014

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 35 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.

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

Various regions in central Victoria were analysed following the 2011 census to determine whether they should be regarded as moderately disadvantaged, slightly disadvantaged, slightly advantaged, moderately advantaged or strongly advantaged. The results are as shown.

Central Victoria
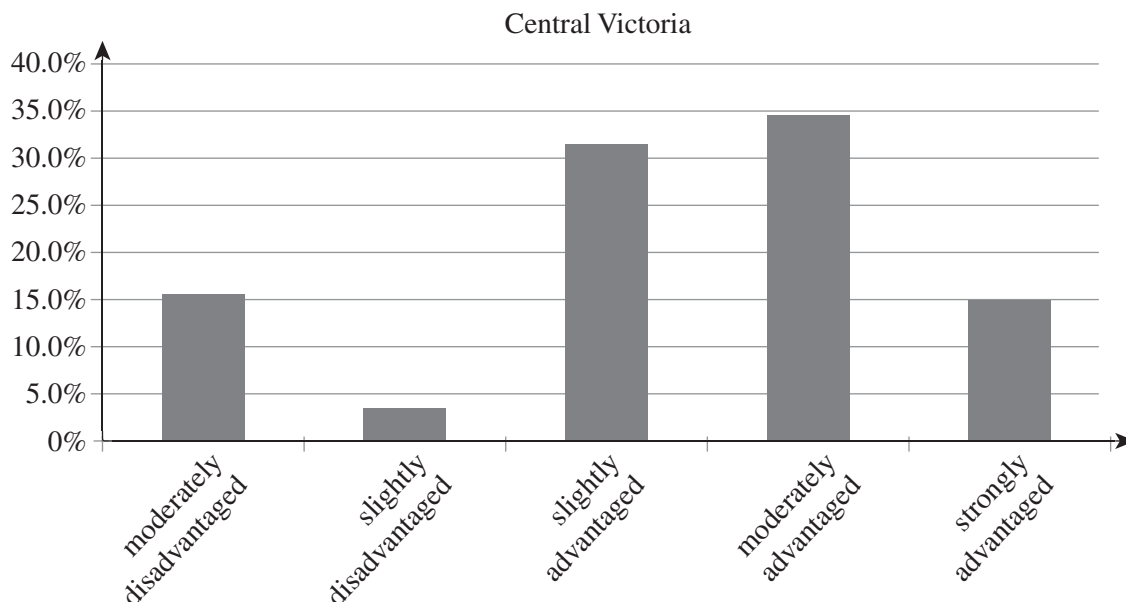
The number of neighbourhoods analysed was 5176. The total number of neighbourhoods classified as moderately advantaged is closest to

A. 35

B. 148

C. 1605

**D.** 1806

E. 2107

Question 2

The mean weight of eggs in a carton is 60 grams each. The carton itself weighs 20 grams and there are 12 eggs contained in it.

The entire weight of carton including the eggs is

A. 80 grams

B. 240 grams

C. 260 grams

D. 720 grams

E. 740 grams

The following information relates to Questions 3 and 4.

The ages of dance contestants for two events are compiled to form box plots for each.
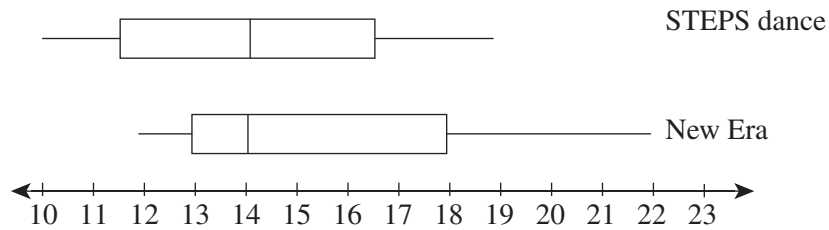
Question 3

If the median is used as the measure of central tendency then we can say that ages of contestants are

A.   the same for both events
B.   higher for the New Era event than STEPS.
C.   higher for the STEPS event than New Era.
D.   significantly more varied for the New Era event than for the STEPS.
E.   significantly more varied for the STEPS event than the New Era event.

Question 4

The organisers of the events wish to compare the age distributions within their events. In particular, they want to find the most common contestant age and the interquartile range of ages. They consider three options:

•   the box plots as shown above,
•   histograms with columns for each individual age and
•   stem and leaf plots in 5 year intervals.

The most appropriate diagram/s to show most common age and the interquartile range

A.   is just the box plot for both requirements.
B.   is just a histogram for both requirements.
C.   is a stem and leaf plot for both requirements.
D.   are a histogram and a box plot.
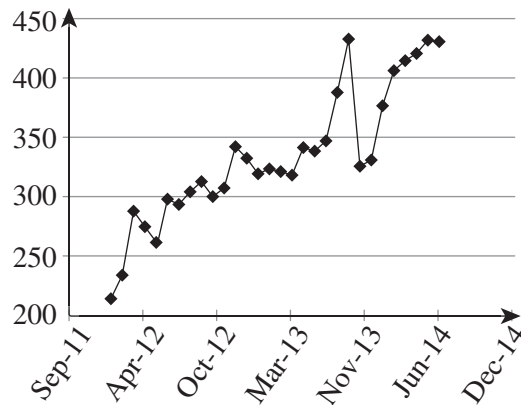E.   are a stem and leaf plot and a histogram.

Question 5

Data showing the monthly changes in a stock market index are to be plotted. The index can be considered to be a continuous distribution. Three different types of graph are being considered. They are shown below as types I, II and III.
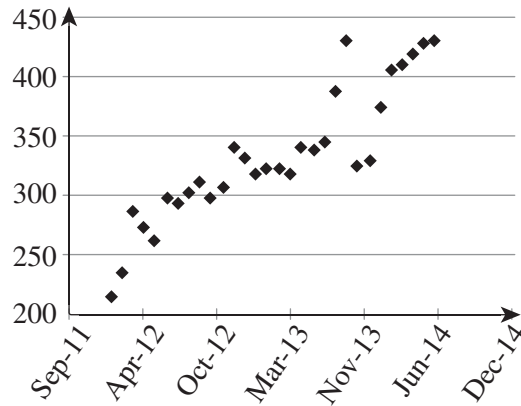
type I
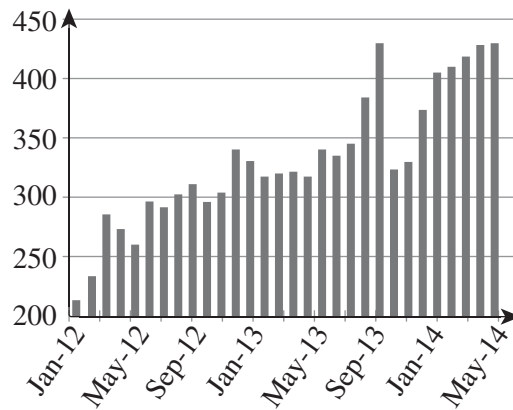
type II

type III

The most appropriate type of graph to show the sequence would be

A.   type I.

B.   type II.

C.   type III.

D.   either I or III (equally valid).

**E.**   either type I or II (equally valid).

Question 6

The mass of dragon fruit at Hong Poi Market is normally distributed with a mean of 800 grams and a standard deviation of 100 grams.

In a shipment of 600 such fruit, the number that we would expect to be over 1000 grams is approximately

A.   10
B.   15
C.   20
D.   96
E.   192

Question 7

The scatterplot below shows how two variables B and C vary against A.
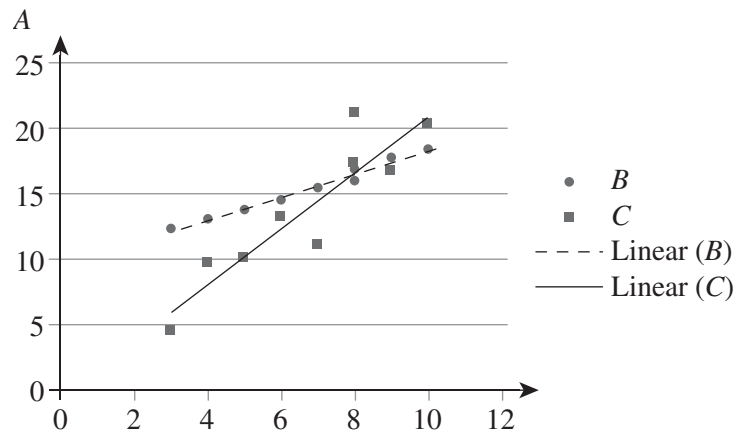
From this plot we can state that the

A.   correlation between A and B exceeds that between A and C.
B.   correlation between A and C exceeds that between A and B.
C.   correlations of A with B and C are approximately equal.
D.   correlation between A and C is approximately 2.1.
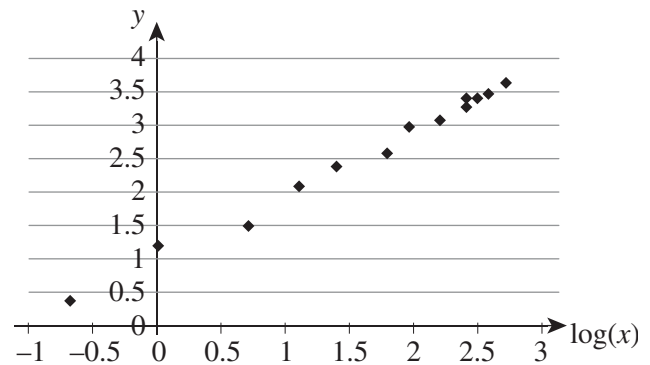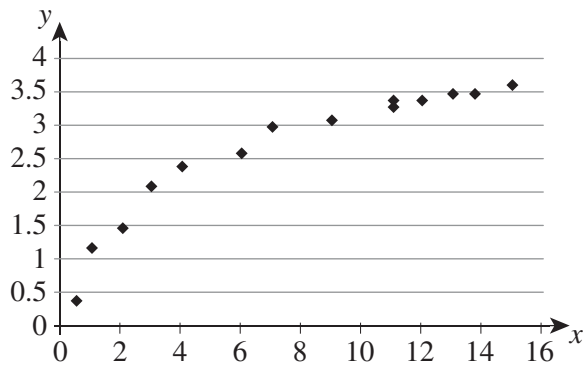**E.**   correlations are unable to be estimated from the graph alone.

Question 8

The table below gives the temperature and rainfall for Rojas City during January 2014.

Date	Temperature (°C)	Rainfall (mm)
1	29	2
2	32	0
3	31	3
4	34	0
5	28	18
6	25	34
7	29	12

The value of the correlation coefficient, r, for this data is closest to

A.   −0.889

B.   −0.710

C.   −0.071

D.   0.889

E.   12.3

Question 9

The above graphs show a comparison of the lengths (y) and widths (x) of a certain type of grasshopper. The graph on the left uses a linear scale while that on the right uses the transformation $\log(x)$ to linearise the data.

Which of these would be the most appropriate least squares regression line?

A. $y = x + 1$

B. $y = 0.3x$

C. $y = \log(x) + 1$

D. $y = 0.3\log(x) + 1$

E. $y = 0.3\log(x)$

Question 10

The scatterplot below shows thickness of the Groblek Ice Sheet over a 5-year period.
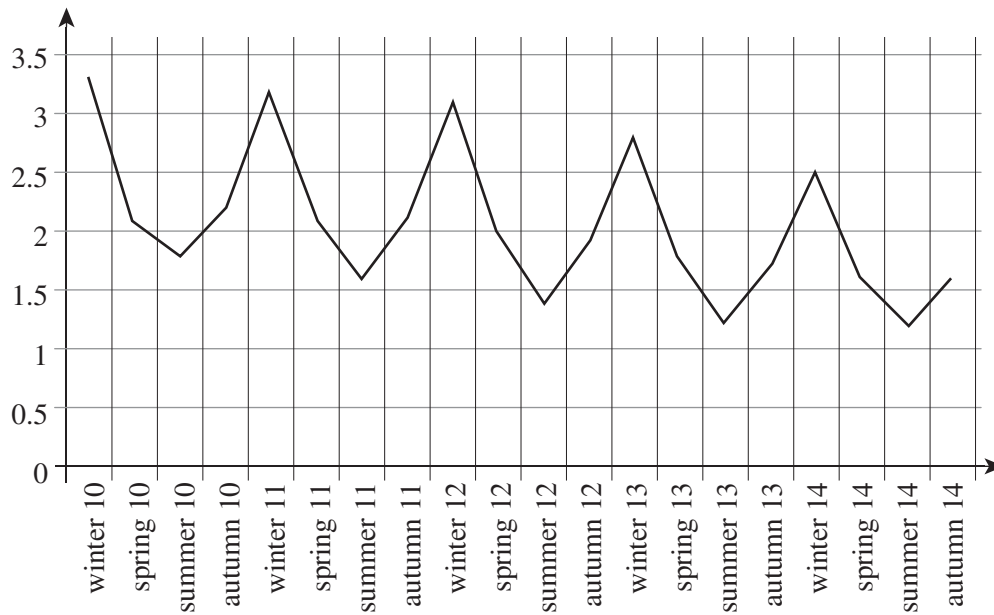
Which of these best describes the pattern shown?

A. seasonal with no trend

B. seasonal with increasing trend

C. seasonal with decreasing trend

D. increasing trend only

E. decreasing trend only

Question 11

Janet has a time series plot showing daily currency variations over 10 days in a row. She sees some day-to-day variations in the plot that she thinks are random. She wants to get a plot without these random variations but does not wish to lose much data. She hopes to have 8 points on her adjusted graph. She considers:

• 3-point smoothing

• 4-point smoothing

• 5-point smoothing

• deseasonalising

It would be best to use

A. 3-point smoothing as these remove single-day variations without too much data loss.

B. 4-point smoothing as this would leave 8 data points and would smooth the data more than 3-point smoothing.

C. 5-point smoothing as this would be the smoothest result.

D. deseasonalising as the biggest problem is daily variations acting in a seasonal manner.

E. any of the 3- 4- or 5-point smoothing as they all achieve Janet's objectives.

The following information relates to Questions 12 and 13.

A trendline was fitted to deseasonalised median property prices in Gondwana City. The equation was deseasonalised price = $1560 \times$ quarter number + 320 000. Quarter numbers are counted with March 2010 as quarter 1 and June 2010 as quarter 2.

The seasonal indices are as given in the table

Quarter	March	June	September	December
Seasonal Index	1.05		1.10	0.95

Question 12

The deseasonalised figure for June 2010 was $306 000.

The actual figure was closest to

A. $275 400

B. $306 000

C. $322 105

D. $340 000

E. $357 895

Question 13

The actual figure for December 2011 was $330 000.

The residual is

A.   –14 888

B.   –14 144

C.   2480

D.   14 144

E.   14 888

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.

Marks will **not** be deducted for incorrect answers.

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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 first four terms on a geometric sequence are 3, –6, 12 and –24.

The 8th term of the sequence is

A. –384
B. –48
C. 48
D. 192
E. 384

Question 2

Lubok Caves are a series of caves with an entrance from the previous cave. Each entrance is narrower than that of the preceding cave. The width reduces by exactly 30% each time. The first entrance is 10 metres wide.

The 5th entrance width is closest to

A. 0.08 metres
B. 2.40 metres
C. 3.00 metres
D. 7.00 metres
E. 27.73 metres

Question 3

David's mother puts aside $100 for him on his first birthday. The amount put aside for him on his second birthday is $150. On his third birthday, $200 is put aside. This process continues, with the amount set aside rising by $50 each year, until he is 18.

The total amount set aside, including that for his 18th birthday, is

A. 950
B. 1800
C. 8500
D. 9350
E. 9450

Question 4

On the day that a concert is announced, 10 000 tickets are sold. On the second and third days, sales number 6000 and 3600 respectively.

If this sales pattern continues indefinitely, the maximum number that could be sold would be

A. 2160
B. 16 667
C. 19 600
D. 21 760
E. 25 000

Question 5

For a certain sequence, terms 1 and 3 are positive while term 2 is negative. Term 3 is less than term 1.

The sequence could be

A.   arithmetic with a negative common difference.

B.   geometric with a negative common ratio. An infinite sum exists and it is less than term 1.

C.   geometric with a negative common ratio. An infinite sum exists and it exceeds term 1.

D.   geometric with a negative common ratio. No infinite sum exists.

E.   geometric with a positive common difference.

Question 6

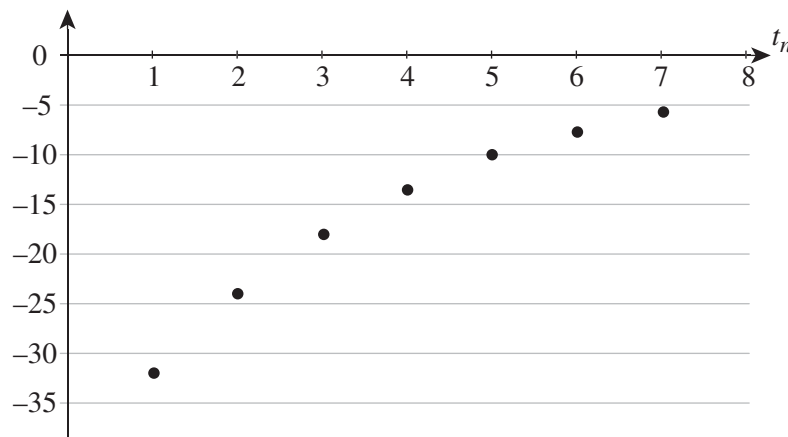A certain sequence is generated by the difference equation

$$t_{n+1} = 3t_n, \qquad t_1 = 4$$

The nth term of the sequence is given by

A. $t_n = 4(3^n)$

B. $t_n = 4(3^{n-1})$

C. $t_n = 4 + 3(n-1)$

D. $t_n = 3(4^{n-1})$

E. $t_n = 3(4^n)$

Question 7

The graph below shows a sequence.

This sequence is most likely to be

A.   geometric with positive common ratio.

B.   geometric with negative common ratio.

C.   arithmetic with positive common difference.

D.   arithmetic with negative common difference.

E.   neither geometric nor arithmetic.

Question 8

The total sum of money in Clive's inheritance is $6000. He will obtain it in 12 installments, however. The smallest of these installments is $100. Each installment is reduced by a constant monetary amount from the preceding installment.

The largest installment is

A. $500
B. $700
C. $900
D. $1000
E. $1100

Question 9

The second-order difference equation $P_{k+1} = 2P_k - P_{k-1}$ governs the population of a certain type of insect.

If the population of the insect halves from 2013 to 2014, then in 2015 it will

A.   remain the same as in 2014.
B.   double again so that it returns to its population of 2013.
C.   halve again.
D.   die out completely.
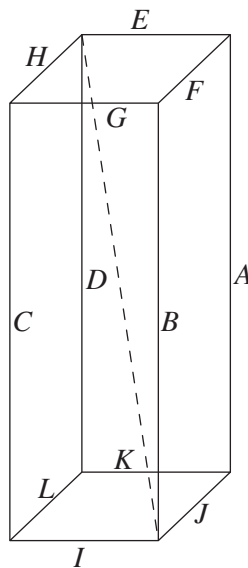E.   reduce slightly but by less than 50% change.

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.
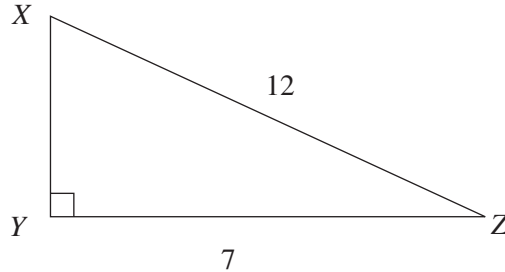
Question 1

In the triangle ΔXYZ, the length XY is closest to

A. 13.89

B. 9.75

C. 5
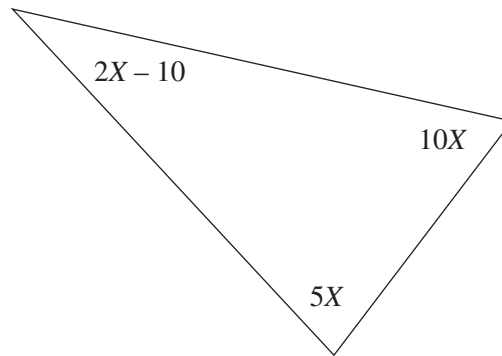
D. 25

E. 95

Question 2

Where $A = B = C = D$

$\qquad H = F = L = J$

$\qquad E = G = K = I$

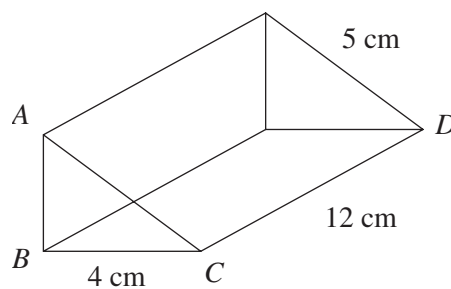The magnitude of the longest length which can be placed into this polygon as represented by a dotted line is

A. $A^2 + B^2 + C^2$

B. $A^2 + J^2 + L^2$

C. $H^2 + B^2 + F^2$

D. $A^2 + B^2 + J^2$

E. $A^2 + I^2 + F^2$

Question 3

The value of *X* can be found by solving

A. $2X - 10 + 10X + 5X = 360$

B. $15X = 180 - 2X - 10$

C. $5X + 10X = 180 - 2X + 10$

D. $5X + 10X = 180 - 2X - 10$

E.   none of the above

Use the following diagram to answer Questions 4 and 5.
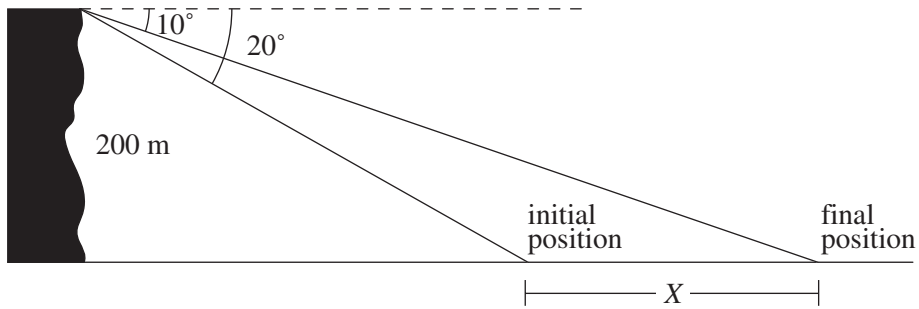

Question 4

The distance *AD* is
A.   12.65
B.   13
C.   13.6
D.   17
E.   21

Question 5

The volume of the prism is found by solving
A. $0.5 \times 3 \times 4 \times 12$
B. $3 \times 4 \times 12$
C. $0.5 \times 4 \times 5 \times 12$
D. $\dfrac{4 \times 5 \times 12}{2}$
**E.** $\dfrac{4 \times 4 \times 12}{2}$

Question 6

From the top of a 200 m cliff, a tourist sees a boat in the distance. The angle of depression of the boat that is sighted is 20° when at this initial position. The boat then travels further out to its final position, the angle of depression now 10°.

What is the distance X, that the boat has travelled?

A.   9 m

B.   584.8 m

C.   529.4 m

D.   1134.3 m

E.   1151.8 m

Use the following diagram to answer Questions 7 and Question 8.
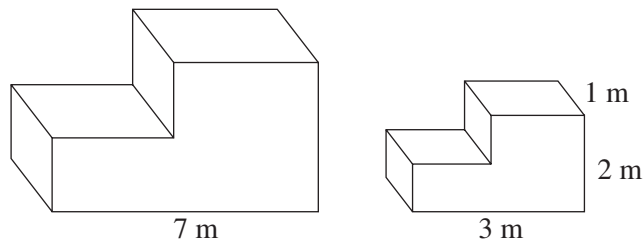
Question 7

The two objects are similar.
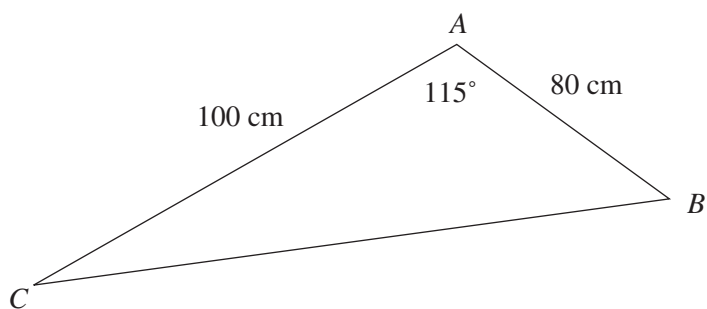
The height of the larger shape is closest to

A. $\dfrac{7}{6}$ cm

B.   4.67 cm

C.   11.5 cm

D.   467 cm

E.   1115 cm

Question 8

If the volume of the larger shape is 80 m^3, find the volume of the smaller shape.

A.   1.865 cm^3

B.   6.297 m^3

C.   6.297 cm^3

D.   14.694 m^3

E.   1016.296 m^3

Question 9

In the triangle ΔABC, the angle $\angle ABC$ is closest to

A.   143.55°
B.   28.45°
C.   36.54°
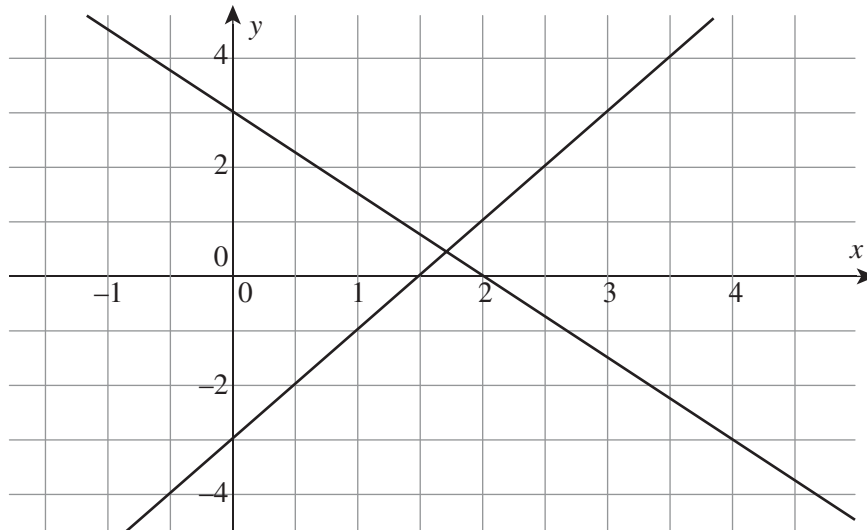**D.**   152.19°
E.   none of the above

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

Which of these lines does not contain the point (–1, 1)?

A. $x + 2y = 1$

B. $y = x + 2$

C. $2x + 3y = 1$

D. $y = 3x + 4$

E. $2x + 5y = 3$

Question 2

Which of the following equations is shown graphed above?

A. $y = 3 - x$

B. $3x + 2y = 6$

C. $2x + 3y = 6$

D. $y = x - 3$

E. $-2x + 3y = 6$

Question 3

If a cappuccino costs $3 and a latte costs $2, the cost of x cappuccinos and y lattes is

A. $3x + 2y$

B. $2x + 3y$

**C.** $5

D. $6xy$

E. $x + y + 5$

Question 4

The Smyth family can get into the movies for a total cost of $38 whilst the Nguyen family must pay $70. The Smyth family has 2 adults and 3 children and the Nguyens have 4 adults and 5 children.

The correct equations to solve in order to find x, the cost of an adult ticket and y, the cost of a child ticket is

A. $2x + 4y = 38$

$3x + 5y = 70$

B. $2x + 4y = 70$

$3x + 5y = 38$

C. $2x + 3y = 38$

$4x + 5y = 70$

D. $2x + 3y = 70$

$4x + 5y = 38$

E. $3x + 2y = 38$

$5x + 4y = 70$

Question 5

The graph shown here illustrates the travel costs on the Sorsohan Provincial bus service.
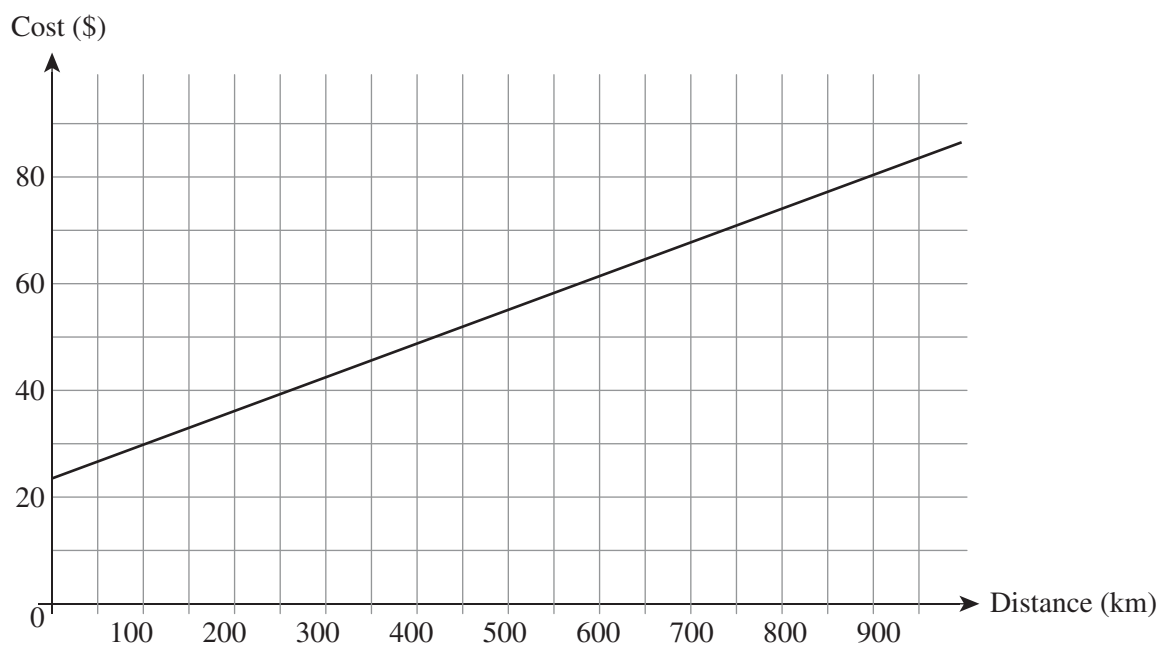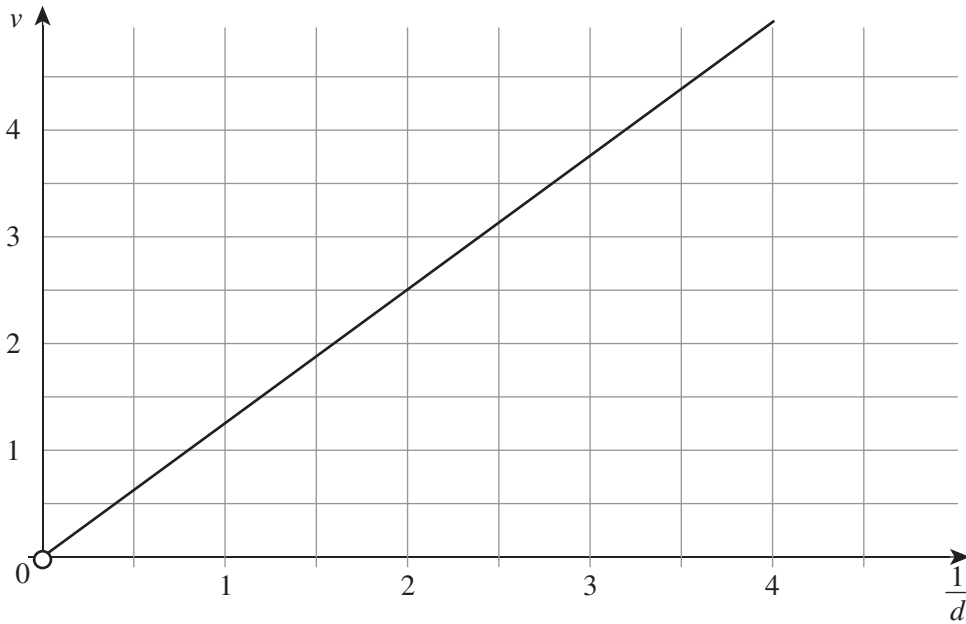

From this we can see that the cost structure is a set cost of

A. $24 plus $16 per km.

B. $16 plus $24 per km.

C. $24 plus 6.25 cents per km

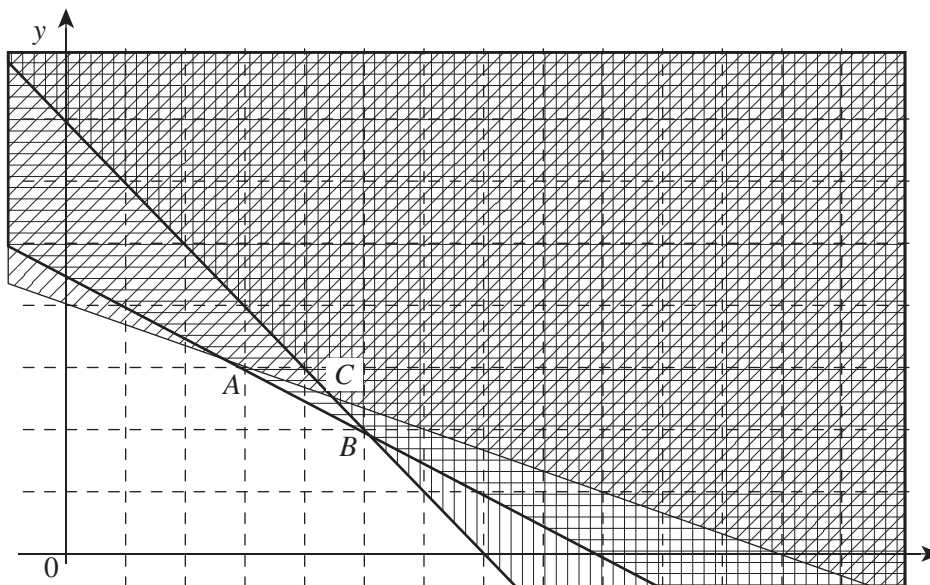D. $16 plus 6.25 cents per km

E. $16 plus 4.17 cents per km.

Question 6

The graph below shows the relationship between wind speed and the reciprocal of distance from the centre of a certain tropical cyclone.

Which of these is true?

A. $v = 1.25d$

B. $v = 0.8d$

C. $vd = \dfrac{5}{4}$

D. $\dfrac{v}{d} = 1.25$

E. $vd = 0.8$

Question 7

Aon knows that 2 equations governing a feasible region are

$$2x + 3y \leq 12$$
$$y \leq 7 - 2x$$

A third equation of the form $x + y \leq c$ forms the 3rd boundary. The scales of both x- and y-axes have been omitted.

For the points A and B to be corners of the feasible region, we require that

A. $4 < c < 4.75$

B. $3.5 < c < 4.75$

C. $3.5 < c < 4$

D. $3.5 < c < 4.5$

E. $4 < c < 45$

Question 8

Parking costs in Braebeach City are as shown in the graph below. The scales of both x- and y-axes have been omitted.
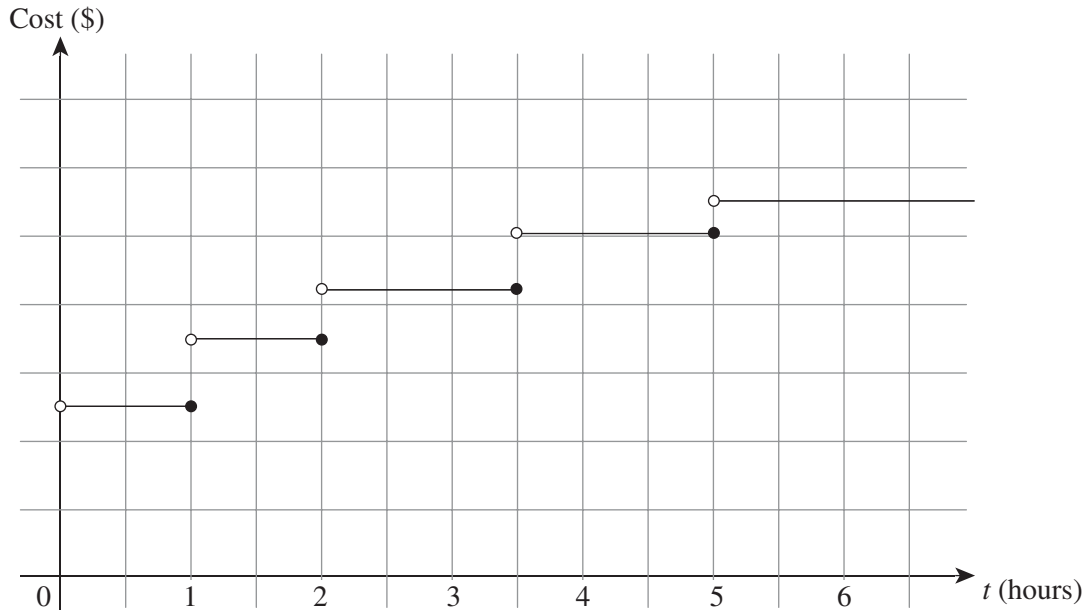
Parking for 3 hours costs $3.40 more than parking for one hour.

The cost of parking for 5 hours will be

A. $5

B. $5.50

C. $8.40

D. $10

E. $11

Question 9

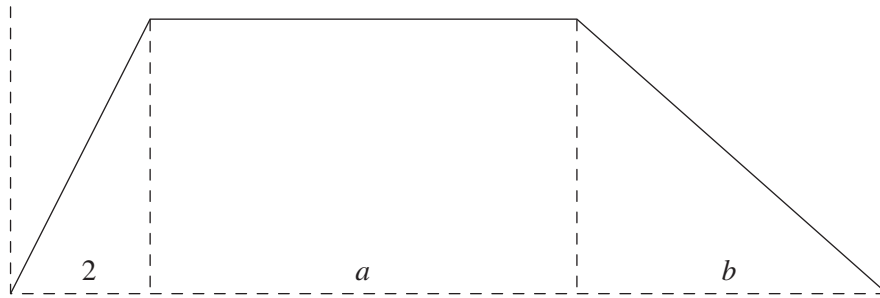A new building is being planned. Its cross-section will consist of three lines as shown. The diagram is not to scale. The base and roof are both horizontal.

The east boundary has gradient of magnitude 1 whilst the western boundary gradient has magnitude 3.

The base of the building, from west to east is 20 metres.

Which of the following equations has been proposed for h, the height of the building at point x metres east of the base of the west wall?

A. $h = \begin{cases} 3x & 0 \le x \le 2 \\ 6 & 2 \le x \le 14 \\ 6 - x & 14 \le x \le 20 \end{cases}$

B. $h = \begin{cases} 3x & 0 \le x \le 2 \\ 6 & 2 \le x \le 18 \\ 6 - x & 18 \le x \le 20 \end{cases}$

C. $h = \begin{cases} 3x & 0 \le x \le 2 \\ 6 & 2 \le x \le 18 \\ 20 - x & 18 \le x \le 20 \end{cases}$

D. $h = \begin{cases} 3x & 0 \le x \le 2 \\ 6 & 2 \le x \le 14 \\ 20 - x & 14 \le x \le 20 \end{cases}$

E. $h = \begin{cases} x & 0 \le x \le 2 \\ 2 & 2 \le x \le 14 \\ 60 - 3x & 14 \le x \le 20 \end{cases}$

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

A house sold for $250 000. The commission paid to the salesperson was $5 000.

The commission as a percentage of the sale price is

A. 2%
B. 5%
C. 10%
D. 25%
E. 50%

Question 2

Oscar enquired about purchasing a new car. The advertised price was $11 100 plus a Goods and Services Tax (GST) of 10%. Oscar decided to purchase this car.

The total amount paid by Oscar was

A. $1 100
B. $9 900
C. $11 100
D. $11 110
E. $12 210

Question 3

Jypsie purchased an electric band saw for $18 500. It depreciates at a rate of $6.50 for each hour of use.

The value of the electric band saw after 1 200 hours of use is

A. $7 800
B. $10 100
C. $10 700
D. $12 000
E. $17 300

Question 4

$44 000 was invested in a simple interest account at the rate of 5% per annum. The account was closed when the balance first reached $52 800.

The length of time of this investment was

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

Question 5

In 2011, the annual rent for a townhouse was $22 800. The annual rent increases by 5.5% at the start of every year.

In 2018 the annual rent will be closest to

A. $31 438

B. $31 578

C. $32 082

D. $33 167

E. $490 068

Question 6

Marshall purchased a new kitchen for $8 100. A deposit of $900 was required. The balance was repaid in 30 equal monthly repayments of $250.

The annual effective interest rate is closest to

A.   2.6%

B.   2.8%

C.   3.2%

D.   4.2%

E.   11.1%

Question 7

Rhys bought a $30 000 sound system on hire purchase. The flat rate of interest charged was 10% per annum. A total of $7 500 interest was charged.

Rhys completed the plan by making the final repayment after

A.   12 months

B.   18 months

C.   24 months

D.   30 months

E.   36 months

Question 8

Robbie selects a perpetuity which pays him $450 per month. The interest rate for the perpetuity is 4.5% per annum.

The amount of Robbie's initial investment must be

A. $450

B. $5 400

C. $24 300

D. $100 000

E. $120 000

Question 9

Bella agreed to a reducing balance loan of $125 000. The loan will be fully repaid after 20 years of monthly repayments. Interest is charged at 5.1% per annum.

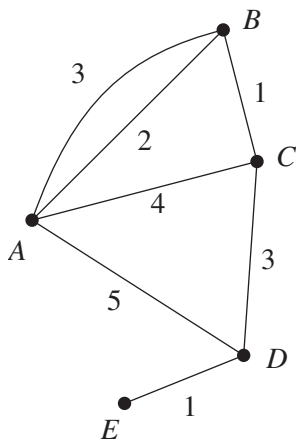The total amount of interest charged after the twelfth repayment is closest to

A. $644

B. $6 289

C. $6 375

D. $6 644

E. $7 729

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.
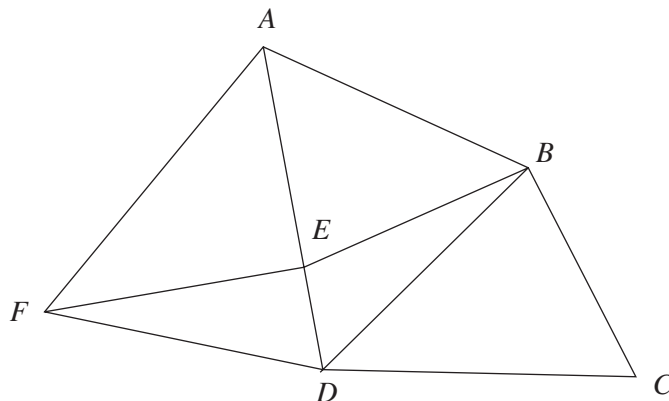
Question 1

The degree of vertex *A* in the diagram given is

A.   4
B.   7
C.   14
D.   15
E.   19
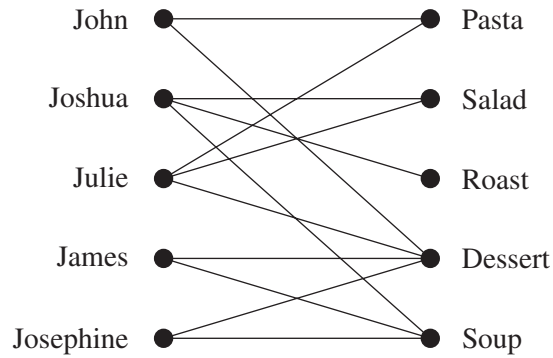
Question 2

By adding a line between which points will the following diagram have a Euler circuit?

A.   *EF*
B.   *DF*
C.   *BD*
D.   *BC*
E.   *AF*

Question 3

The following diagram illustrates what dishes different members of a party are able to make.

John		Pasta
Joshua		Salad
Julie		Roast
James		Dessert
Josephine		Soup

If each member must prepare only one dish, then Julie must prepare

A.   pasta

B.   salad

C.   roast

D.   dessert

E.   soup

Question 4

The following matrix represents Soccer teams *A*, *B*, *C*, *D*, and *E* and their dominance over each other.

$$
\begin{array}{c}
\;A\;B\;C\;D\;E \\
\begin{array}{c} A \\ B \\ C \\ D \\ E \end{array}
\begin{bmatrix}
0 & 1 & 0 & 1 & 1 \\
1 & 0 & 0 & 0 & 1 \\
1 & 0 & 0 & 1 & 1 \\
1 & 1 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0
\end{bmatrix}
\end{array}
$$

Using two step dominance, which team is the best?

A.   *A*

B.   *B*

C.   *C*

D.   *D*

E.   *E*

Question 5
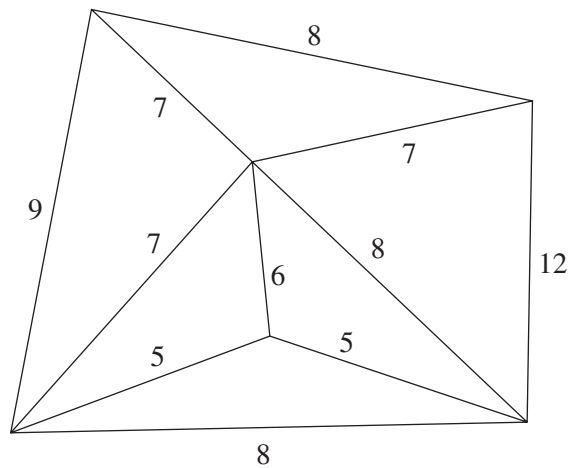
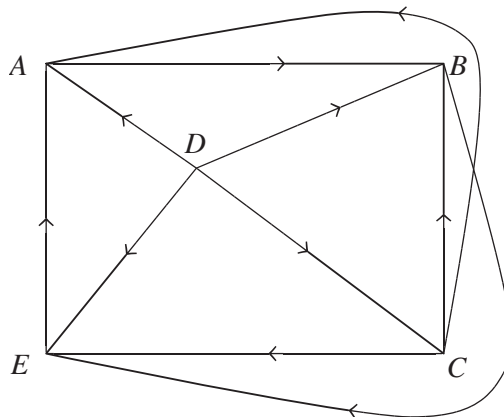For the diagram above, the total of all edges of the minimum spanning tree is

A. 5
B. 12
C. 30
D. 31
E. 32

Question 6

A competition requires 5 people labelled *A*, *B*, *C*, *D* and *E*, to play in a round robin to see who is the best player.

Which player would be ranked second in this competition?

A. *A*
B. *B*
C. *C*
D. *D*
E. *E*

Question 7

A connected planar graph has 12 edges and 6 faces.

The number of vertices for this graph is

A.   8
B.   16
C.   18
D.   20
E.   28

Question 8
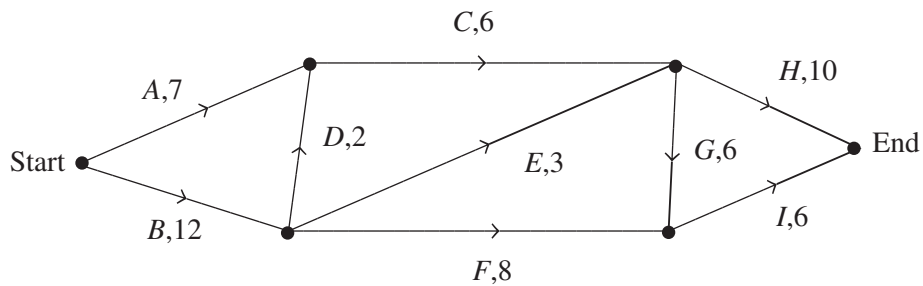
The maximum flow for the above diagram is

A.   15
B.   16
C.   17
D.   21
E.   24

Question 9

The critical path for this diagram is

A. $A–C–D–H–I$
B. $B–C–F–H–I$
C. $B–C–E–H–I$
D. $A–E–H–I$
E. $A–F–H–I$

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

If matrix A is 5×4, matrix C is 5×3 and $AB = C$, then
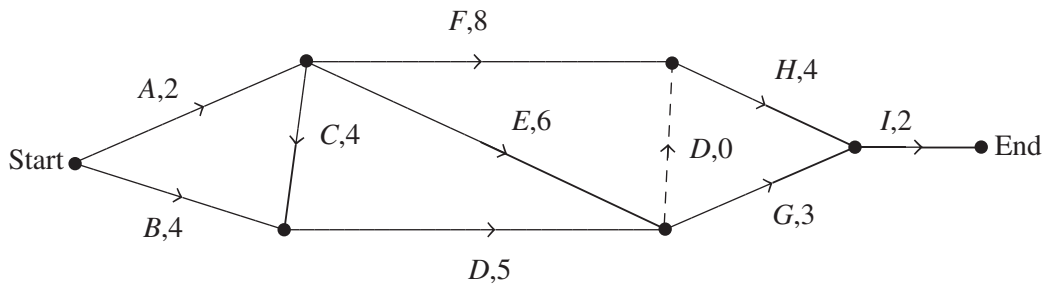**A.** Matrix B is undefined.
B. Matrix B has order 3×4.
C. Matrix B has order 4×3.
D. Matrix B exists but order is unknown.
E. Matrix B has ordered 5×3.

Question 2

Matrix P contains profits of various coffees. It is of the form $\begin{bmatrix} \text{cappuccino} \\ \text{latte} \\ \text{espresso} \end{bmatrix}$.

Matrix R contains orders for coffees. It is a 3×3 matrix for which rows 1, 2 and 3 refer to shops A, B and C and columns 1, 2 and 3 refer to cappuccinos, lattes and espressos respectively.

To produce a matrix containing the profit from each of the 3 shops (3×1 or 1×3) we could
A. calculate matrix product PR.
B. calculate matrix product RP.
C. calculate matrix product $P^T R$.
D. calculate matrix product $R^T P$.
E. none of the above

Question 3

$$2x + 3y + z = 7$$
$$3x - 2z = 5$$
$$y - 4z = 1$$

The simultaneous linear equations above can be solved using matrix methods as follows

A. $\begin{bmatrix} 2 & 3 & 1 \\ 3 & 0 & -2 \\ 0 & 1 & -4 \end{bmatrix} \begin{bmatrix} 7 \\ 5 \\ 1 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 3 & 1 \\ 3 & 0 & -2 \\ 0 & 1 & -4 \end{bmatrix}^{-1} \begin{bmatrix} 7 \\ 5 \\ 1 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 3 & 1 \\ 3 & -2 & 0 \\ 1 & -4 & 0 \end{bmatrix} \begin{bmatrix} 7 \\ 5 \\ 1 \end{bmatrix}$

D. $\begin{bmatrix} 2 & 3 & 1 \\ 3 & -2 & 0 \\ 1 & -4 & 0 \end{bmatrix}^{-1} \begin{bmatrix} 7 \\ 5 \\ 1 \end{bmatrix}$

E. $\begin{bmatrix} 2 & 3 & 0 \\ 3 & 0 & 1 \\ 1 & -2 & -4 \end{bmatrix} \begin{bmatrix} 7 \\ 5 \\ 1 \end{bmatrix}$

Question 4

The matrix $\begin{bmatrix} 2 & a \\ 3 & 5 \end{bmatrix}$ will have an inverse if and only if

A. $a = 10 - 3$

B. $a > \dfrac{10}{3}$

C. $a < \dfrac{10}{3}$

D. $a \neq \dfrac{10}{3}$

E. $a = \dfrac{6}{5}$

Question 5

From one year to the next, the general trend amongst support for three political parties, *A*, *B* and *C*, is given

by the transition matrix $\begin{bmatrix} 0.7 & 0.1 & 0.05 \\ 0.2 & 0.8 & 0.05 \\ 0.1 & 0.1 & a \end{bmatrix}$.

The support in 2011 for the 3 parties was given by state matrix $\begin{bmatrix} 0.5 \\ 0.4 \\ 0.1 \end{bmatrix}$.

In 2012 it will be

A. $\begin{bmatrix} 0.395 \\ 0.425 \\ 0.09 \end{bmatrix}$

B. $\begin{bmatrix} 0.395 \\ 0.425 \\ 0.17 \end{bmatrix}$

C. $\begin{bmatrix} 0.44 \\ 0.38 \\ 0.135 \end{bmatrix}$

D. $\begin{bmatrix} 0.44 \\ 0.38 \\ 0.18 \end{bmatrix}$

E. $\begin{bmatrix} 0.395 \\ 0.425 \\ 0.18 \end{bmatrix}$

Question 6

A certain transition matrix T is given by $\begin{bmatrix} 0.9 & 0.1 & 0.3 \\ 0.1 & 0.9 & 0.4 \\ 0 & 0 & 0.3 \end{bmatrix}$. It is noted that, when this matrix is applied to a given

initial state, the proportions in this state do not change.

From this we can infer

A. that the initial state was $\begin{bmatrix} 0.5 \\ 0.5 \\ 0 \end{bmatrix}$.

B. that the initial state was $\begin{bmatrix} 0.333 \\ 0.333 \\ 0.333 \end{bmatrix}$.

C. nothing about the initial state as it is final state that matters here.

D. only that the last element (bottom value) in the initial state matrix is zero.

E. that the initial state was $\begin{bmatrix} 0.3 \\ 0.4 \\ 0.3 \end{bmatrix}$.

The following information refers to questions 7 and 8

A sequence of 3×1 matrices, S_n is defined according to the rule $S_{(n+1)} = P(S_n - Q)$

where $P = \begin{bmatrix} 0.4 & 0.3 & 0.5 \\ 0.4 & 0.6 & 0.4 \\ 0.2 & 0.1 & 0.1 \end{bmatrix}$ and $Q = \begin{bmatrix} 12 \\ 10 \\ 5 \end{bmatrix}$.

Question 7

If $S_1 = \begin{bmatrix} 100 \\ 100 \\ 50 \end{bmatrix}$, then $S_2 =$

A. $\begin{bmatrix} 95 \\ 120 \\ 35 \end{bmatrix}$

B. $\begin{bmatrix} 83 \\ 110 \\ 30 \end{bmatrix}$

C. $\begin{bmatrix} 84.7 \\ 107.2 \\ 31.1 \end{bmatrix}$

D. $\begin{bmatrix} 88 \\ 90 \\ 45 \end{bmatrix}$

E. $\begin{bmatrix} 95.2 \\ 96.0 \\ 49 \end{bmatrix}$

Question 8

If S_7 is known, we can determine the value of S_6 by calculating

A. $PS_7 + Q$

B. $P^{-1}S_7 + Q$

C. $P^{-1}(S_7 + Q)$

D. $P(S_7 - Q)$

E. $P(S_6 - Q)$

Question 9

The transition matrix $T = \begin{bmatrix} 0.7 & 0.1 & 0.3 \\ 0.2 & 0.6 & 0.2 \\ 0.1 & 0.3 & 0.5 \end{bmatrix}$ governs the transition in Science, Business and Law courses from

one year to the next according to $S_{n+1} = TS_n$ where $S_n = \begin{bmatrix} \text{Science} \\ \text{Business} \\ \text{Law} \end{bmatrix}$. Equal numbers of students are

enrolled in each course in year 1.

It is not true that

A. 30% of Science students change in the following year.

B. 50% of Law students stay with the same course for the next year also.

C. 54% of Science students will be doing the same course 2 years later.

D. 36% of Business students will be doing the same course 2 years later.

E. 38% of students will be enrolled for Science 2 years later.

END OF MULTIPLE-CHOICE QUESTION BOOKLET