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INSIGHT
YEAR 12 Trial Exam Paper

2012

FURTHER MATHEMATICS
Written Examination 1
MULTIPLE-CHOICE QUESTION BOOK

Reading time: 15 minutes

Writing time: 1 hour 30 minutes

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of modules</i>	<i>Number of modules to be answered</i>	<i>Number of marks</i>
A	13	13			13
B	54	27	6	3	27
					Total 40

- Students are permitted to bring the following items into the examination: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference that may be annotated (can be typed, handwritten or a textbook), one approved graphics calculator (memory DOES NOT have to be cleared) and, if desired, one scientific calculator.
- Students are NOT permitted to bring blank sheets of paper or white out liquid/tape into the examination.

Materials provided

- The Question book of 31 pages, with an answer sheet for the multiple-choice questions.
- A separate sheet with miscellaneous formulas.
- Working space is provided throughout the Question book.

Instructions

- Write your **name** in the box provided on the multiple-choice answer sheet.
- Remove the formula sheet during reading time.
- Unless otherwise indicated, diagrams in this book are **not** drawn to scale.

At the end of the examination

- You may keep this Question book.

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

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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.

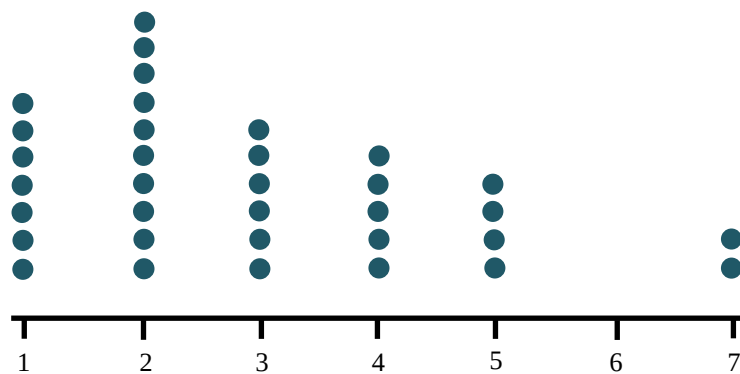
Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Core: Data analysis

Use the following information to answer Questions 1, 2 and 3.

The dot plot below shows the distribution of the number of beds in each of 34 households in a retirement village.



Question 1

The median of this distribution is

- A. 2
- B. 2.5
- C. 3
- D. 3.5
- E. 4

Question 2

The percentage of the households that have fewer than three beds is closest to

- A. 68%
- B. 60%
- C. 54%
- D. 50%
- E. 33%

Question 3

Correct to one decimal place, the mean and standard deviation, respectively, of this distribution are

- A. $\bar{x} = 2.9$ $s = 1.7$
- B. $\bar{x} = 2.9$ $s = 1.6$
- C. $\bar{x} = 1.7$ $s = 2.9$
- D. $\bar{x} = 2.5$ $s = 1.2$
- E. $\bar{x} = 2.5$ $s = 1.6$

SECTION A – continued
TURN OVER

Question 4

The variables

salary (high, medium, low)
time spent watching television (hours)

- A. are both numerical.
- B. are both categorical.
- C. are numerical and categorical, respectively.
- D. are categorical and numerical, respectively.
- E. are neither categorical nor numerical.

Use the following information to answer Questions 5 and 6.

The heights of tulips in a botanic garden have a normal distribution with a mean of 42 cm and a standard deviation of 6.6 cm.

Question 5

The percentage of tulips that have a height between 22.2 cm and 48.6 cm is

- A. 99.7%
- B. 95%
- C. 81.5%
- D. 68%
- E. 83.85%

Question 6

Anne bought a tulip from the garden shop. The tulip that Anne bought has a standardised height of $z = 2.5$. This corresponds to an actual tulip height of

- A. 48.6 cm
- B. 55.2 cm
- C. 58.5 cm
- D. 60 cm
- E. 61.8 cm

Question 7

In an investigation to find the relationship between the food energy content (in calories) and the carbohydrate content (in grams) of 20 different brands of standard-sized packets of biscuits (each packet of biscuits being 100 grams), the following summary statistics were obtained.

the total carbohydrate content = 1504 grams
the total energy content = 11 600 calories
standard deviation of carbohydrate content = 3.5 grams
standard deviation of energy content = 32 calories
Pearson's correlation coefficient = 0.86

In this investigation, energy content is the dependent variable. The y-intercept of the corresponding least squares regression line is

- A. 0.86
- B. -7.86
- C. 7.86
- D. 11.29
- E. -11.29

Use the following information to answer Questions 8, 9 and 10.

The following data give the heights (in centimetres) and weights (in kilograms) of nine people.

Height (in cm)	168	155	147	175	172	158	182	190	161
Weight (in kg)	58	50	45	70	65	51	83	102	54

After analysing the data, the least squares regression equation to predict the weights of these people from their heights is found to be

$$\text{weight} = -151.0346 + 1.2847 \times \text{height}$$

Question 8

From the height and weight measurements given in the table above, it can be concluded that the percentage of the variation in *weights* of the people that can be explained by the variation in their *heights* is closest to

- A. 95.8%
- B. 99.6%
- C. 85.3%
- D. 91.7%
- E. 75.4%

Question 9

The residual for a height of 182 cm is closest to

- A. -0.2
- B. 82.8
- C. 0.2
- D. 83
- E. -82.8

Question 10

After analysing the residual plot, the relationship between *weights* and *heights* of these people is found to be non-linear. In an attempt to linearise the data, a reciprocal transformation is applied to the variable *weight*.

The equation of the least squares regression line that allows the reciprocal of the *weights* of these people to be predicted from their *heights* is closest to

- A. $\text{weight} = 0.07 - 2.93 \times \text{height}$
- B. $\frac{1}{\text{weight}} = 0.0657 - 0.0003 \times \text{height}$
- C. $\text{weight} = 0.0657 - 0.0003 \times \text{height}$
- D. $\frac{1}{\text{weight}} = 0.07 - 2.93 \times \text{height}$
- E. $\text{weight} = 0.07 - \frac{2.93}{\text{height}}$

Use the following information to answer Questions 11 and 12.

The seasonal index for hay fever tablet sales by a chemist shop during spring is 1.6.

Question 11

The hay fever tablet sales that the chemist shop makes during spring is typically

- A. 40% above the quarterly average.
- B. 60% below the quarterly average.
- C. 37.5% below the quarterly average.
- D. 60% above the quarterly average.
- E. 37.5% above the quarterly average.

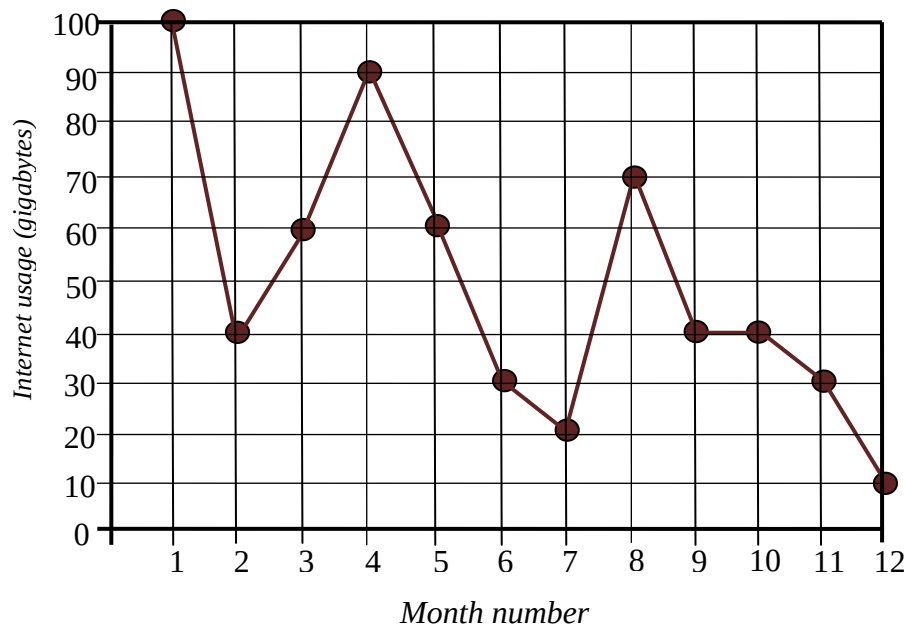
Question 12

To correct for seasonality, the hay fever tablet sales figures for spring should be

- A. increased by 60%.
- B. increased by 37.5%.
- C. reduced by 60%.
- D. reduced by 40%.
- E. reduced by 37.5%.

Question 13

The data below show the internet usage (in gigabytes of information downloaded) by a computer at an internet café in Melbourne from January to December.



The **six** median smoothed internet usage value centred at the seventh month is

- A. 45
- B. 40
- C. 30
- D. 20
- E. 47

END OF SECTION A

SECTION B

Instructions for Section B

Select **three** modules and answer **all** questions within the modules selected on the answer sheet provided.

Indicate 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.

One mark will be awarded for a correct answer; no marks will be awarded for an incorrect answer.

Marks **are not** deducted for incorrect answers.

No marks will be awarded if more than one answer is completed for any question.

Module	Page
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SECTION B

Module 1: Number patterns

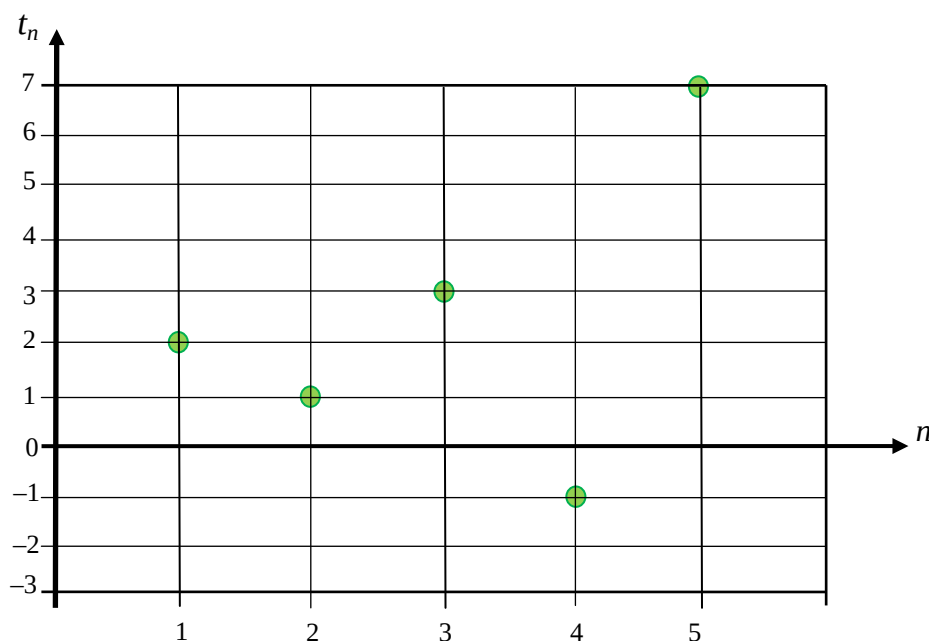
Before answering these questions you must **shade** the Number patterns box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

For the sequence $-3, 4, 11, 18, \dots$ the sum of the first 15 terms is

- A. 450
- B. 690
- C. 300
- D. 960
- E. 470

Question 2



The first five terms of a sequence are plotted on the graph above. Which of the following difference equations matches the sequence in the graph?

- A. $t_{n+1} = t_n - 1$ where $t_1 = 2$
- B. $t_{n+1} = 2t_n - 3$ where $t_1 = 2$
- C. $t_{n+1} = -t_n + 3$ where $t_1 = 2$
- D. $t_{n+1} = -2t_n + 5$ where $t_1 = 2$
- E. $t_{n+1} = 3t_n - 5$ where $t_1 = 2$

Question 3

The sixth, tenth and fourteenth terms of a sequence are 3, 27 and 243, respectively. This sequence

- A. must be arithmetic with the seventh term being 9.
- B. must be geometric with the seventh term being $3\sqrt{3}$.
- C. can be geometric with the seventh term being $3\sqrt{3}$, but is not necessarily so.
- D. can be arithmetic with the seventh term being 9, but is not necessarily so.
- E. cannot be either arithmetic or geometric.

Question 4

The number of mangoes in the bottom layer of a huge fruit display is 100. Each successive layer contains three fewer mangoes than the layer below.

This pattern of stacking mangoes in layers continues.

The maximum number of mangoes that can be stacked in this way is

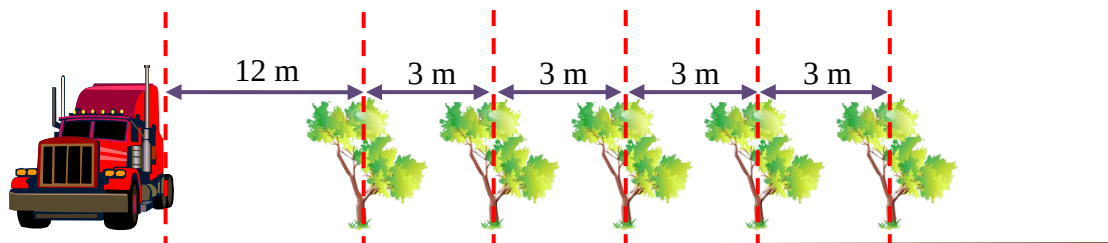
- A. 34
- B. 3400
- C. 1695
- D. 2520
- E. 1717

Question 5

For which one of the following geometric sequences is an infinite sum able to be determined?

- A. $\frac{1}{81}, -\frac{1}{27}, \frac{1}{9}, -\frac{1}{3}, \dots$
- B. $1, 3, 9, 27, \dots$
- C. $-1, 3, -9, 27, \dots$
- D. $27, -9, 3, -1, \dots$
- E. $\frac{1}{81}, \frac{1}{27}, \frac{1}{9}, \frac{1}{3}, \dots$

Use the following information to answer Questions 6 and 7.



Adam, the farmer, has some trees to be planted on a line, 3 metres apart. The truck containing trees is 12 metres from the point at which the first tree is to be planted.

The trees are very heavy and Adam can carry only one at a time. As a result he has to collect the first tree from the truck, carry it to its position, plant it, and return to the truck. Then he has to get the second tree, carry it to its position, plant it, return to the truck, get the third tree and so on.

Question 6

If D_n is the distance from the truck to the n th tree and back to the start, a difference equation that can be used to model the distance is

- | | | | |
|----|----------------------|-------|------------|
| A. | $D_{n+1} = D_n + 3$ | where | $D_1 = 12$ |
| B. | $D_{n+1} = D_n + 15$ | where | $D_1 = 12$ |
| C. | $D_{n+1} = D_n + 6$ | where | $D_1 = 24$ |
| D. | $D_{n+1} = 3D_n$ | where | $D_1 = 12$ |
| E. | $D_{n+1} = 6D_n + 6$ | where | $D_1 = 24$ |

Question 7

In carrying out his work, Adam walks at least 1.2 kilometres a day while planting trees. Find the minimum number of trees he would need to plant in order for the total distance he walks while planting these trees to be at least 1.2 kilometres.

- | | |
|----|----|
| A. | 27 |
| B. | 16 |
| C. | 10 |
| D. | 14 |
| E. | 17 |

Question 8

Serra has taken out a \$400 000 loan to purchase an investment property. The amount of money she owes to the bank at the start of the n th year is found to follow the difference equation

$$M_{n+1} = 1.1M_n - 75\,500$$

This is consistent with

- A. 1% interest being charged each year and then Serra depositing \$75 500 in the bank.
- B. Serra withdrawing \$75 500 from the bank each year and then 1% interest being charged.
- C. 9% interest being charged each year and then Serra depositing \$75 500 in the bank.
- D. 10% interest being charged each year and then Serra withdrawing \$75 500 from the bank.
- E. 10% interest being charged each year and then Serra depositing \$75 500 in the bank.

Question 9

Tony has a rabbit farm where he breeds and sells rabbits. He realises that the number of rabbits after n months can be modelled by the difference equation

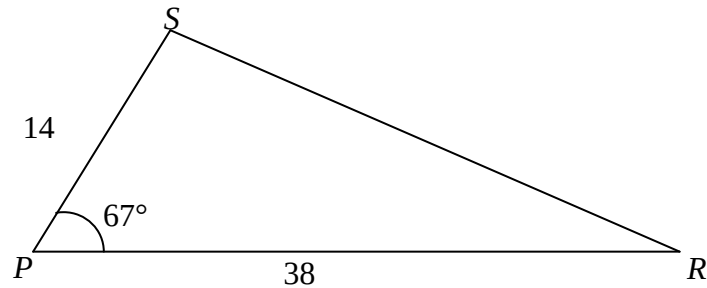
$$R_n = 3R_{n-1} - R_{n-2} \quad \text{where } R_0 = 4 \text{ and } R_1 = 3$$

The number of rabbits that Tony has after nine months is

- A. 1453
- B. 3804
- C. 9959
- D. 981
- E. 198

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 and write the name of the module in the box provided.



In triangle PRS , $\angle SPR = 67^\circ$.

The length of side $PS = 14$ cm and $PR = 38$ cm.

Question 1

The area of triangle PRS in centimetres squared is closest to

- A. 245
- B. 233
- C. 104
- D. 142
- E. 358

Question 2

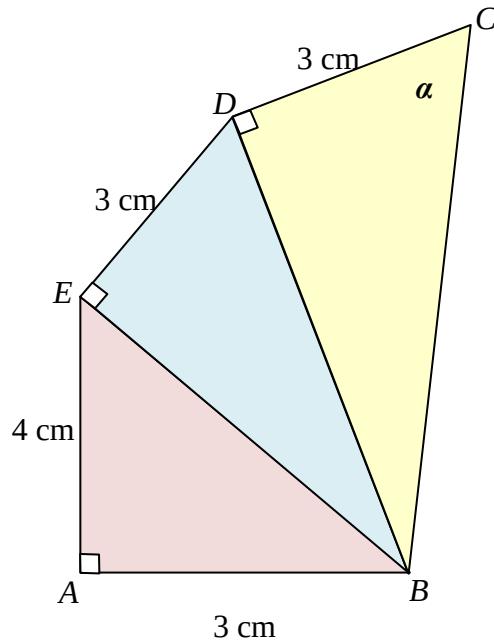
The length of side SR is closest to

- A. 24.35 cm
- B. 28.58 cm
- C. 34.99 cm
- D. 39.85 cm
- E. 42.22 cm

Question 3

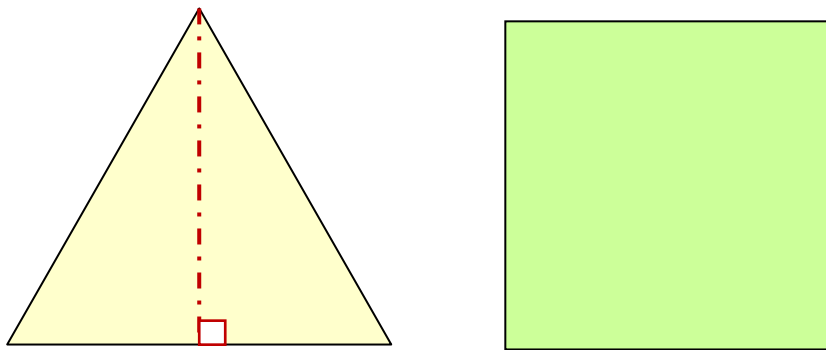
The magnitude of $\angle PSR$ is closest to

- A. 73°
- B. 80°
- C. 85°
- D. 89°
- E. 94°

Question 4

For the triangles in the diagram above, the magnitude of angle α is closest to

- A. 27°
- B. 55°
- C. 94°
- D. 63°
- E. 58°

Question 5

The square shown above has an area of 64 cm^2 .

The height of the equilateral triangle shown above is equal to the side length of the square.

The area of the triangle is closest to

- A. 8 cm^2
- B. 32 cm^2
- C. 36.95 cm^2
- D. 38.57 cm^2
- E. 18.48 cm^2

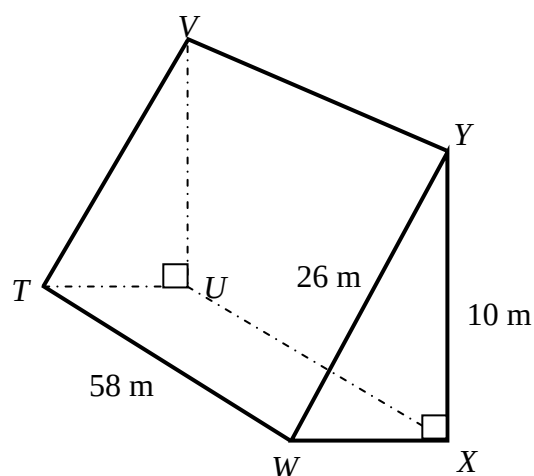
Question 6

Members of a group of students on school camp go bushwalking from their campsite (C) to a river (R) along a straight fire track for a distance of 4 km on a bearing of 65° .

They then walk along another straight fire track for a distance of 5 km on a bearing of 215° . They stop for fishing at this spot (F). The bearing of the fishing spot from the original campsite at C is closest to

- A. 138° T
- B. 147° T
- C. 115° T
- D. 082° T
- E. 115° T

Use the following information to answer Questions 7 and 8.



The storage container above is a prism with a cross-section in the shape of a right-angled triangle. As can be seen from the diagram above, the edges are the following lengths.

$$TW = 58 \text{ m}$$

$$XY = 10 \text{ m}$$

$$WY = 26 \text{ m}$$

Question 7

A cable is to connect directly from point T to point Y . The length of the cable is closest to

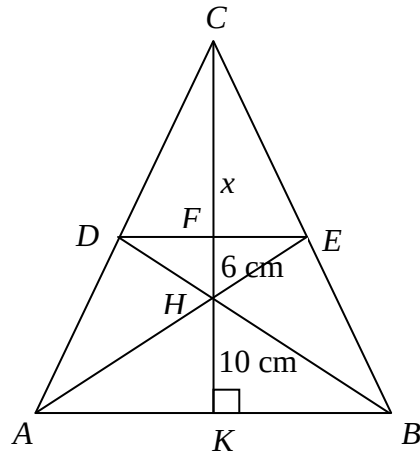
- A. 58.86 m
- B. 59.23 m
- C. 42 m
- D. 64.34 m
- E. 63.56 m

Question 8

The volume of the storage container is

- A. $10\,450 \text{ m}^3$
- B. 8590 m^3
- C. 7540 m^3
- D. 6960 m^3
- E. 5436 m^3

Question 9



In triangle ABC shown above, $DE \parallel AB$ and $CK \perp AB$.

$FH = 6$ cm and $HK = 10$ cm.

The length of CF , in cm, is closest to

- A. 8
- B. 9.6
- C. 12
- D. 20.2
- E. 24

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 and write the name of the module in the box provided.

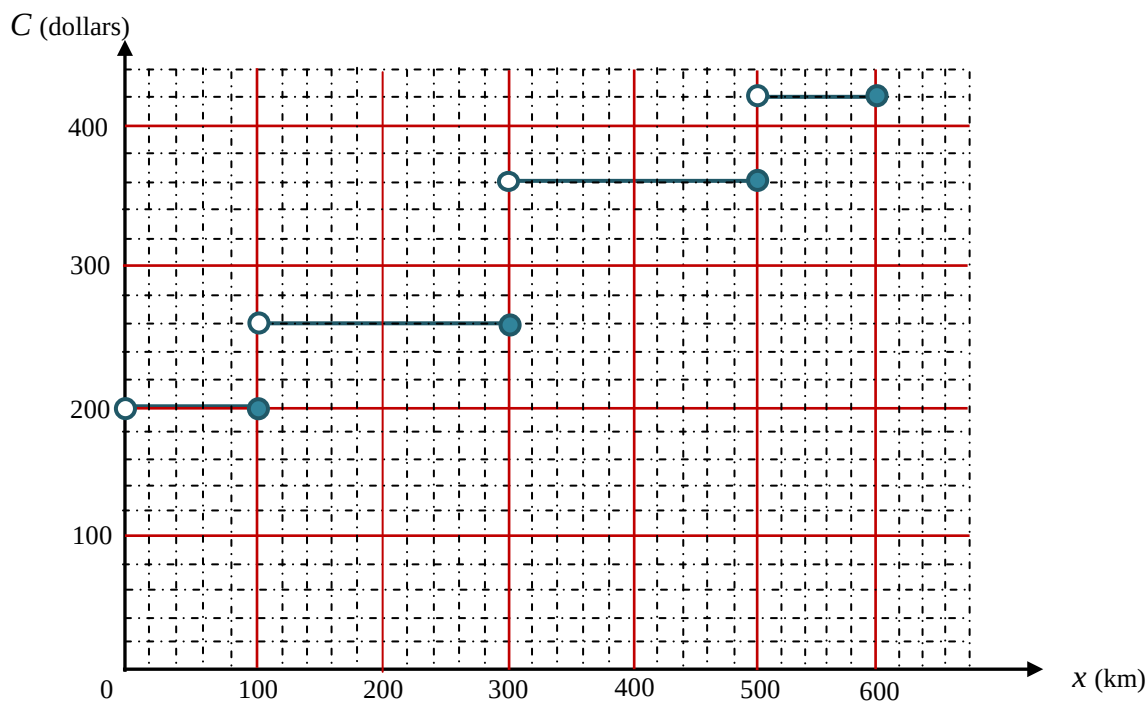
Question 1

For the straight line with equation $6y - 5x = 30$, which of the following statements is true?

- A. the y-intercept is 30
- B. the gradient is -5
- C. the x-intercept is -6
- D. as x increases, y decreases
- E. the straight line has a negative slope

Use the following information to answer Questions 2 and 3.

The charge, C , in dollars, of a car rental company is based on the number of kilometres, x , the car travelled during the rental period. The graph below shows the charge of renting a car depending on its usage, in kilometres.



Question 2

Jacqueline rents a car from the car rental company and travels for a certain distance using this car. She then returns this car to the company and rents another car.

She travels a total of 600 kilometres with the two cars.

The minimum amount of money that she would pay for renting the two cars is

- A. \$420
- B. \$520
- C. \$560
- D. \$620
- E. \$780

Question 3

Jacqueline's friend Sally rented three cars for her family and friends during her vacation in Queensland. She paid a total of \$920. The usage of each car could have been

- A. 150 km, 200 km and 300 km, respectively.
- B. 300 km, 400 km and 500 km, respectively.
- C. 120 km, 280 km and 190 km, respectively.
- D. 320 km, 500 km and 100 km, respectively.
- E. 350 km, 490 km and 220 km, respectively.

Question 4

The line joining the points (2, 2) and (−4, −13) would have the equation

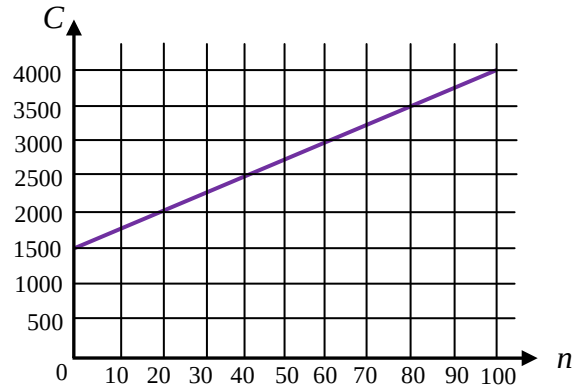
- A. $y = \frac{5}{2}x - 3$
- B. $5x + 2y = 6$
- C. $y = \frac{7}{2}x - 5$
- D. $7x - 2y = 5$
- E. $2x + 2y = -13$

Question 5

The system of simultaneous equations $5x + 3y = 9$ and $2y = 6 - \frac{10}{3}x$

- A. have a solution at point (3, 5).
- B. have a solution at point (1, −5).
- C. have a solution at point (−3, −7).
- D. have no solution.
- E. have infinitely many solutions.

Use the following information to answer Questions 6 and 7.



On the graph above, the straight line representing the cost of the production of n jackets by a textile company is given.

The revenue equation for the sale of n jackets is $R = 50n$.

Question 6

The number of jackets needed to be produced, and sold, to break even is

- A. 30
- B. 45
- C. 60
- D. 75
- E. 90

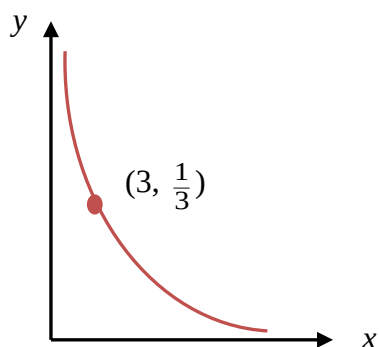
Question 7

A particular number of jackets was produced and sold. It resulted in a profit of \$3000. The number of jackets produced and sold was

- A. 60
- B. 90
- C. 100
- D. 120
- E. 180

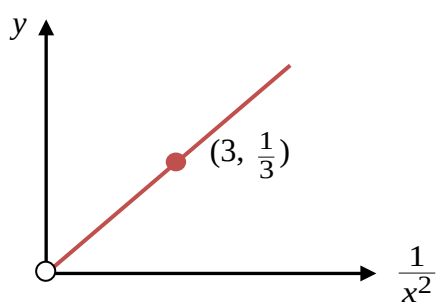
Question 8

A graph representing the relation between y and x is shown below.

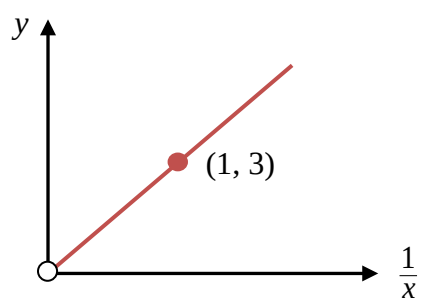


A graph that shows this same relationship could be

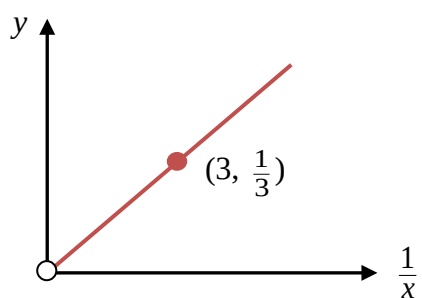
A.



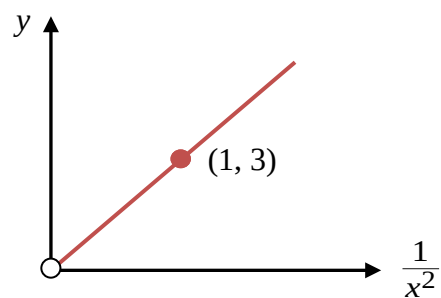
B.



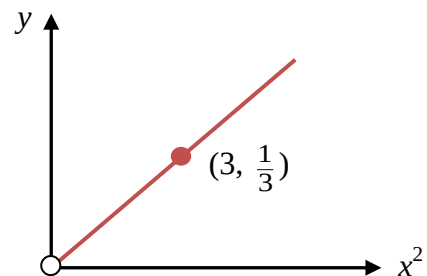
C.



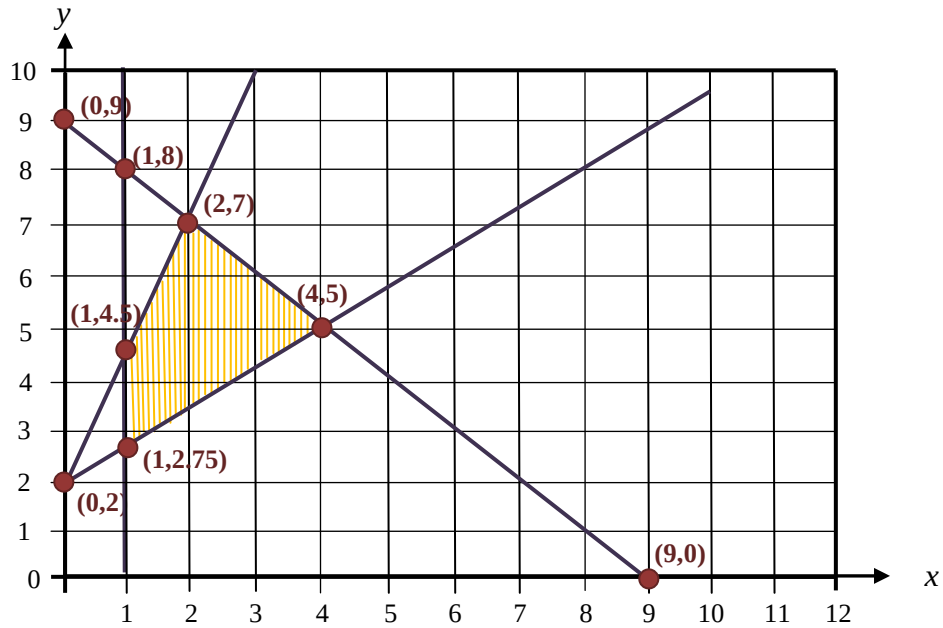
D.



E.



Question 9



In the graph above, the shaded region, with boundary included, represents the feasible region for a linear programming problem. The objective function for this problem is Z .

The minimum value of Z occurs at any point that lies on the line that joins points $(2, 7)$ and $(4, 5)$ in the feasible region.

The rule for the objective function, Z , could be

- A. $Z = x + y$
- B. $Z = 2x + 3y$
- C. $Z = 3x - 2y$
- D. $Z = -2x - 2y$
- E. $Z = x - y$

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 and write the name of the module in the box provided.

Alice received \$460 750 from the sale of her house after paying the real estate agent's commission.

The real estate agent deducted a commission of 3% of the sale price before giving the balance to Alice. The sale price of Alice's house was

- A. \$475 000
- B. \$490 000
- C. \$446 927.50
- D. \$474 572.50
- E. \$520 000

Question 2

The amount of interest earned on a principal of \$120 000 invested at 5.6% per annum for five years, compounding quarterly would be given by

- A. $120\,000 \times 1.56^{20}$
- B. $120\,000 \times 1.014^{20}$
- C. $120\,000(1.56^{20} - 1)$
- D. $120\,000 \times 1.56^5$
- E. $120\,000(1.014^{20} - 1)$

Question 3

Jordan signs a hire-purchase contract to buy a new sofa set.

The contract specifies that there are to be monthly payments for eighteen months.

The flat rate of interest is 9.3% per annum.

The effective interest rate for this contract is closest to

- A. 21.5%
- B. 18.6%
- C. 17.6%
- D. 15.8%
- E. 14.8%

Question 4

Janna bought a box of chocolates for \$18 in January 2010.

The inflation rate was 2.8% in 2010 and 3.5% in 2011.

How much would Janna pay for the same box of chocolates at the start of 2012?

- A. \$18.50
- B. \$19.15
- C. \$19.82
- D. \$23.04
- E. \$31.10

Question 5

A school purchased a photocopier for \$24 500 and it depreciates at a flat rate of 22.5% per annum.

If the photocopier's scrap value is \$3000, the number of years before the photocopier will be written off is closest to

- A. 2 years
- B. 3 years
- C. 4 years
- D. 5 years
- E. 6 years

Question 6

Ellen wants to invest \$100 000 at 5% per annum, compounding monthly, for 5 years. Another option the bank provides for her is to invest her money at a flat rate of interest of 6% per annum for 5 years.

Ellen calculates the interest that she will receive for each option and finds out that she will be better off with the second option.

According to her calculations, the difference in the interest that she will receive from each of the two options at the end of the 5-year period is closest to

- A. \$28 335.87
- B. \$3822.56
- C. \$2371.84
- D. \$5000
- E. \$1664.13

Question 7

Jessica borrows \$85 000 and makes weekly repayments of \$210 at an interest of 8.4% per annum.

Two years after she takes out the loan, the interest rate decreases to 6.2% per annum.

If she continues to repay the same weekly amount after the rate decrease, the reduction in the time it will take her to repay the whole loan will be closest to

- A. 12.6 years
- B. 10.6 years
- C. 4.5 years
- D. 1.4 years
- E. 1.1 years

Question 8

Walter wants to buy a three-dimensional television with a home theatre system that costs \$6980 when paid for in cash.

The electronics store is also offering a payment plan with 15% deposit and the outstanding amount to be paid in 60 monthly payments of \$125.

The amount Walter saves by paying cash is

- A. \$8547
- B. \$1567
- C. \$2345
- D. \$3655
- E. \$869

Question 9

Jeremy and Jane borrow \$456 000 to purchase their home.

They are offered a reducing balance loan for 30 years with an interest rate of 8.65% per annum, compounding fortnightly.

They decide to repay the loan in 15 years instead of 30 years and there are no penalties for repaying the loan early.

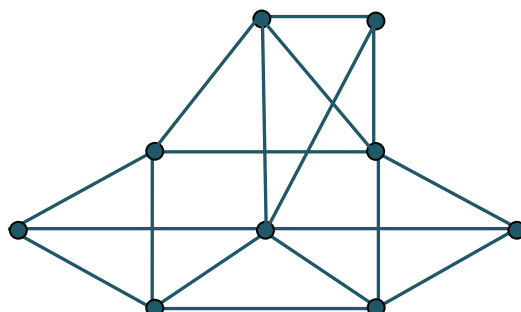
Which of the following statements is **not** true?

- A. The total amount of repayments will be less.
- B. Each fortnightly repayment will increase.
- C. The amount they will save will be more than \$450 000.
- D. Each fortnightly repayment will be more than \$2000.
- E. The amount they owe after 10 years will be less than \$200 000.

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 and write the name of the module in the box provided.

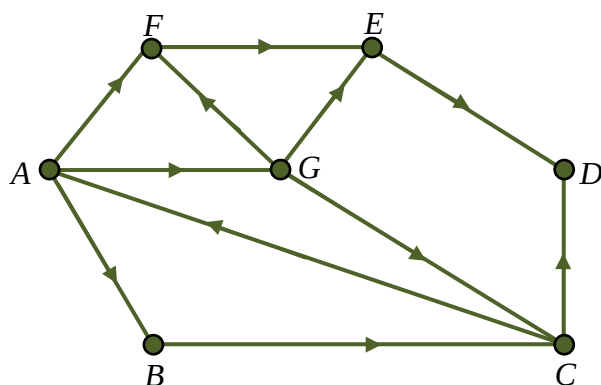
Question 1



The graph shown above has

- A. 9 faces
- B. 11 faces
- C. 14 faces
- D. 18 faces
- E. 19 faces

Question 2

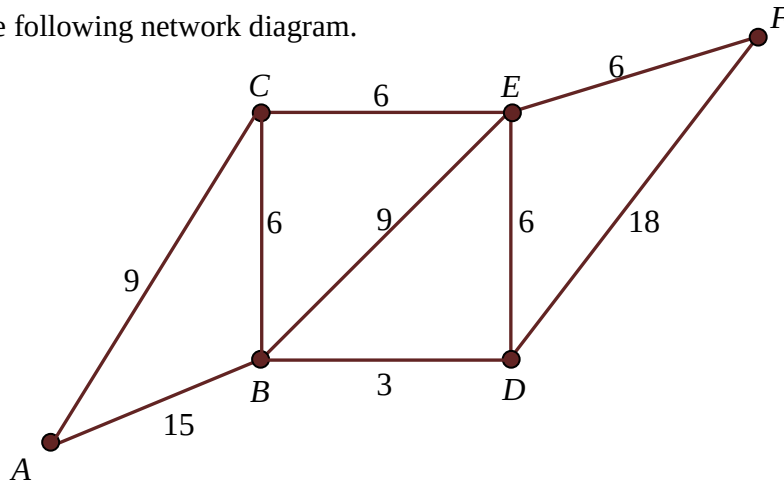


If matrix R is the adjacency matrix for the network above, 'vertex G is reachable from vertex B ' is shown by

- A. R , R^2 and R^5 .
- B. R^2 and R^3 .
- C. R^3 and R^6 .
- D. R^2 , R^4 and R^7 .
- E. R^2 , R^3 and R^6 .

Use the following information to answer Questions 3, 4 and 5.

Consider the following network diagram.



Question 3

The degree of vertex E is

- A. 2
- B. 3
- C. 4
- D. 5
- E. 6

Question 4

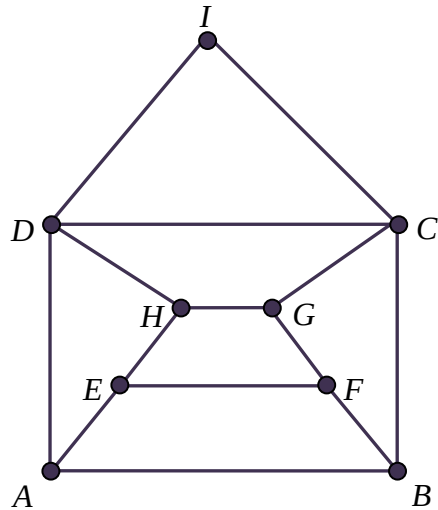
The minimum spanning tree for the network above has a weight of

- A. 78
- B. 60
- C. 33
- D. 30
- E. 27

Question 5

The shortest path from A to E is

- A. $A \rightarrow B \rightarrow E$
- B. $A \rightarrow C \rightarrow E$
- C. $A \rightarrow B \rightarrow D \rightarrow E$
- D. $A \rightarrow B \rightarrow C \rightarrow E$
- E. $A \rightarrow C \rightarrow B \rightarrow D \rightarrow F \rightarrow E$

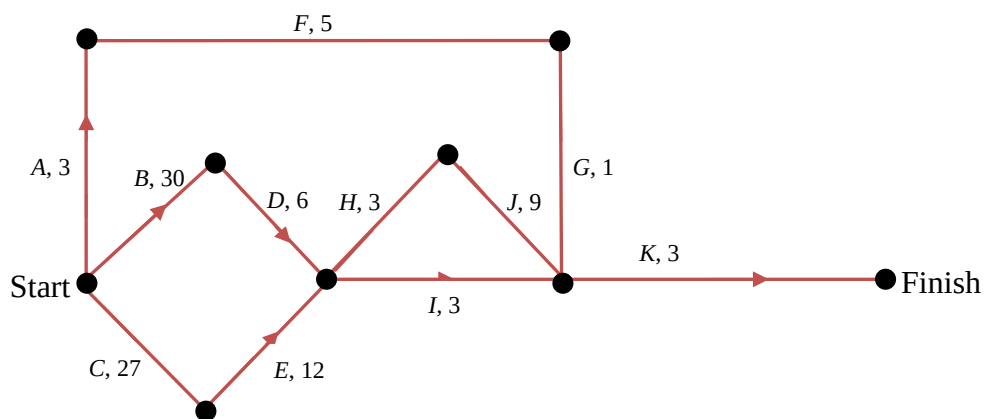
Question 6

A Hamiltonian circuit for the network above is

- A. *AEFBCGHDI*
- B. *IDAEHGFBC*
- C. *ABCDEFGHIA*
- D. *AEHGCIDHGFB*
- E. *BADICGHEFB*

Use the following information to answer Questions 7 and 8.

A project has 11 activities. The network below shows all these activities together with the time it takes, in days, to complete each activity.

**Question 7**

The shortest time, in days, in which this project can be completed is

- A. 42
- B. 54
- C. 68
- D. 72
- E. 96

Question 8

Float time, in days, for activity F is

- A. 42
- B. 39
- C. 18
- D. 8
- E. 3

Question 9

The information below shows the time (in hours) that each of the three dance teachers, Reesha, Henry and Alexandra, would take to complete teaching each of the dance styles flamenco (F), Latin dance (L) and hip-hop (H) to the dance students for a school performance night.

	F	L	H
<i>Reesha</i>	32	44	51
<i>Henry</i>	41	52	53
<i>Alexandra</i>	28	25	27

If each teacher is allocated only one dance style to teach, the minimum total time, in hours, for this group of dance teachers to complete teaching all three dance styles for the performance night is

- A. 98
- B. 105
- C. 110
- D. 117
- E. 125

Module 6: Matrices

Before answering these questions you must **shade** the Matrices box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

The determinant of the matrix $\begin{bmatrix} -14 & 2a \\ 28 & -3 \end{bmatrix}$ is 154.

The value of a is

- A. 4
- B. -4
- C. 2
- D. -2
- E. 7

Question 2

Given $\begin{bmatrix} -2 & 3 \\ 2 & 5 \end{bmatrix} + \begin{bmatrix} 7 & 2 \\ 1 & 3 \end{bmatrix} \times \begin{bmatrix} 1 & 5 \\ 4 & 2 \end{bmatrix}$, the matrix calculation would be represented by

- A. $\begin{bmatrix} -2 + 7 \times 1 & 3 + 2 \times 5 \\ 2 + 1 \times 4 & 5 + 3 \times 2 \end{bmatrix}$
- B. $\begin{bmatrix} -2 + 7 \times 1 \times 2 \times 4 & 3 + 7 \times 5 \times 2 \times 2 \\ 2 + 1 \times 1 \times 3 \times 4 & 5 + 1 \times 5 \times 3 \times 2 \end{bmatrix}$
- C. $\begin{bmatrix} -2 + 7 + 1 & 3 + 2 + 5 \\ 2 + 1 + 4 & 5 + 3 + 2 \end{bmatrix}$
- D. $\begin{bmatrix} -2 \times 7 \times 1 & 3 \times 2 \times 5 \\ 2 \times 1 \times 4 & 5 \times 3 \times 2 \end{bmatrix}$
- E. $\begin{bmatrix} -2 + 7 \times 1 + 2 \times 4 & 3 + 7 \times 5 + 2 \times 2 \\ 2 + 1 \times 1 + 3 \times 4 & 5 + 1 \times 5 + 3 \times 2 \end{bmatrix}$

Question 3

If $A = \begin{bmatrix} -4 & 8 & 2 \\ 3 & 5 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 5 \\ -6 \end{bmatrix}$ and $C = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$, then $3B - AC$ equals

- A. $\begin{bmatrix} 9 \\ -36 \end{bmatrix}$
- B. $\begin{bmatrix} -1 \\ -24 \end{bmatrix}$
- C. $\begin{bmatrix} 15 \\ -18 \end{bmatrix}$
- D. $\begin{bmatrix} 6 \\ 18 \end{bmatrix}$
- E. $\begin{bmatrix} -21 \\ 0 \end{bmatrix}$

Question 4

For the matrix $\begin{bmatrix} -7 & 32 & -11 & -1 \\ 8 & 55 & 23 & -5 \\ 15 & 16 & 42 & 0 \\ 53 & -2 & 18 & 34 \\ 12 & -1 & 5 & 81 \end{bmatrix}$, the product of element $m_{4,2}$ and element $m_{3,2}$ is

- A. -115
- B. -46
- C. -32
- D. -80
- E. 0

Question 5

The system of simultaneous equations

$$\begin{aligned} -2y + z + w &= -12 \\ x + y + z - w &= 21 \\ x + y + 2w &= 34 \\ x + y + z + w &= 48 \end{aligned}$$

can be solved by evaluating the matrix product

A. $\begin{bmatrix} 0 & -2 & 1 & 1 \\ 1 & 1 & 1 & -1 \\ 1 & 1 & 0 & 2 \\ 1 & 1 & 1 & 1 \end{bmatrix} \times \begin{bmatrix} -12 \\ 21 \\ 34 \\ 48 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 2 & -1 & -1 \\ -1 & -1 & -1 & 1 \\ -1 & -1 & 0 & -2 \\ -1 & -1 & 1 & -1 \end{bmatrix} \times \begin{bmatrix} -12 \\ 21 \\ 34 \\ 48 \end{bmatrix}$

C. $\begin{bmatrix} 0 & -2 & 1 & 1 \\ 1 & 1 & 1 & -1 \\ 1 & 1 & 0 & 2 \\ 1 & 1 & 1 & 1 \end{bmatrix} \times \begin{bmatrix} 12 \\ -21 \\ -34 \\ -48 \end{bmatrix}$

D. $\begin{bmatrix} 0.5 & 3 & 1.5 & -2 \\ -1 & -0.5 & -0.5 & 1 \\ 0 & -0.5 & -1 & 1 \\ 0 & -0.5 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} -12 \\ 21 \\ 34 \\ 48 \end{bmatrix}$

E. $\frac{1}{2} \begin{bmatrix} 1 & 3 & 3 & -4 \\ -1 & -1 & -1 & 2 \\ 0 & -1 & -2 & 3 \\ 0 & -1 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} -12 \\ 21 \\ 34 \\ 48 \end{bmatrix}$

Question 6

The median house prices in towns A, B and C are to increase by 6%, 9% and 15%, respectively.

If current prices are, in matrix format, $H = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$, where a , b and c represent the current median

house prices in towns A, B and C, respectively, then the prices after the increase would be

A. $H \times I$, where $I = \begin{bmatrix} 0.06 & 0 & 0 \\ 0 & 0.09 & 0 \\ 0 & 0 & 0.15 \end{bmatrix}$

B. $H \times I$, where $I = \begin{bmatrix} 1.06 & 0 & 0 \\ 0 & 1.09 & 0 \\ 0 & 0 & 1.15 \end{bmatrix}$

C. $H \times I$, where $I = \begin{bmatrix} 6 \\ 9 \\ 15 \end{bmatrix}$

D. $H + I$, where $I = \begin{bmatrix} 1.06 \\ 1.09 \\ 1.15 \end{bmatrix}$

E. $H - I$, where $I = \begin{bmatrix} 1.06 \\ 1.09 \\ 1.15 \end{bmatrix}$

Question 7

Matrix X is a 4×4 matrix and thirteen of the elements are zero.

Matrix Y contains twelve elements, none of which are zero.

Matrix Z contains six elements, two of which are zero.

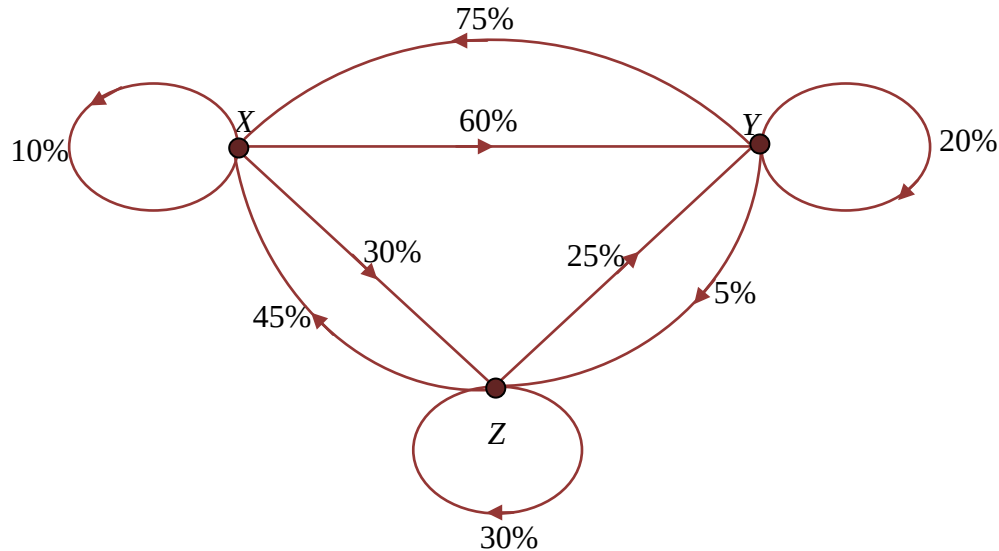
Assuming the matrix product $(XY)Z$ is defined, the minimum number of zero elements in the product matrix $(XY)Z$ is

- A. 9
- B. 6
- C. 4
- D. 3
- E. 2

Use the following information to answer Questions 8 and 9.

Customers of a car service company can choose to take their vehicles to one of three car service branches: X, Y or Z.

The company had 2000 customers at the beginning. 1000 of those customers preferred to take their vehicles to branch X, 800 customers preferred branch Y and the rest preferred branch Z. The transition diagram below shows the percentage of customers who will take their vehicles to the same branch or to one of the other two branches for car services from month to month.



Question 8

Assume the pattern of movement shown in the transition diagram continues.

The total number of customers who will change the car service branch they take their vehicles to after one month is

- A. 320
- B. 450
- C. 1260
- D. 1680
- E. 1850

Question 9

The management board of the company made a decision to shut down the branch that has the least number of customers at the end of one year.

The number of customers the branch that will be shut down after one year has is closest to

- A. 400
- B. 411
- C. 754
- D. 790
- E. 834

END OF MULTIPLE CHOICE QUESTION BOOK