

insight™
YEAR 12 Trial Exam Paper

2014

FURTHER MATHEMATICS

Written examination 1

Reading time: 15 minutes

Writing time: 1 hour 30 minutes

MULTIPLE-CHOICE QUESTION BOOK

Structure of book

<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 book 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

- A question book of 43 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 and/or any other unauthorised 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 and 2.

During June, the number of cars sold by a dealership each day (a total of 25 days, excluding Sundays) was:

4, 5, 4, 6, 7, 8, 5, 3, 0, 12, 4, 6, 3, 8, 0, 13, 3, 5, 6, 12, 4, 0, 4, 6, 8

Question 1

The mode for the number of cars sold each day is

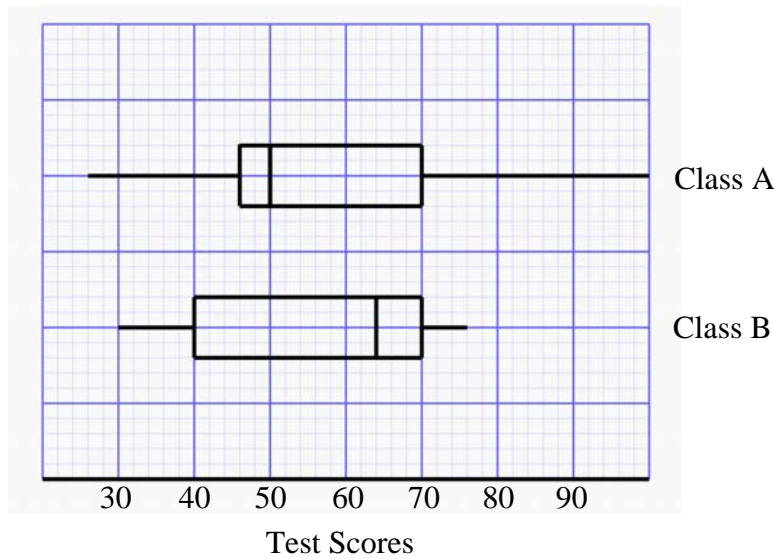
- A. 3
- B. 4
- C. 5
- D. 5.44
- E. 4 and 6

Question 2

To test for outliers, the lower and upper fences are calculated. The lower and upper fences, respectively, are

- A. 3.5 and 7.5
- B. 0.0 and 13.0
- C. -0.5 and 11.5
- D. -2.5 and 13.5
- E. 0.0 and 13.5

SECTION A – continued
TURN OVER

Question 3

The boxplots above summarise the scores of Class A and Class B on a science test. There were 20 students in each class. Which of the following statements is **incorrect**?

- A. Class A's scores are positively skewed and Class B's scores are negatively skewed.
- B. The interquartile range of Class B's scores is greater than the interquartile range of Class A's scores.
- C. More students scored below 40 in Class B than in Class A.
- D. The mean of Class B's scores is lower than the median of Class B's scores.
- E. The number of students who scored above 50 in Class A is equal to the number of students who scored below 62 in Class B.

Question 4

Ten scores have a mean and standard deviation of 15.3 and 2.6, respectively. If the 5 highest scores are increased by 2 and the 5 lowest scores are decreased by 2, which of the following statements is **incorrect**?

- A. The standard deviation remains unchanged.
- B. The interquartile range is increased.
- C. The range is increased.
- D. The mean remains unchanged.
- E. The median remains unchanged.

Question 5

The weights of empty soft drink cans are normally distributed with a mean of 25 g. If 81.5% of all empty soft drink cans weigh between 24.85 g and 25.30 g, then the standard deviation, in g, of empty soft drink cans is closest to

- A. 0.05
- B. 0.10
- C. 0.15
- D. 0.25
- E. 0.30

Use the following information to answer Questions 6 and 7.

Data recorded in the table below shows the Further Mathematics study scores for 10 students and the mean number of minutes of study time spent on Further Mathematics each evening during the year.

Study score	25	43	37	39	45	28	30	49	40	43
Study time (minutes)	10	60	30	40	45	5	15	75	35	50

Question 6

Based on a regression analysis, which of the following statements is false?

- A. Study time is the independent variable.
- B. The relationship between the variables is strong, positive and linear.
- C. Students who studied for longer tended to have higher study scores.
- D. Other factors influence study scores more than study time.
- E. Study time could be used to predict study scores.

Question 7

The equation of the least squares regression line is

- A. Study Time = $25.69 \times \text{Score} + 0.33$
- B. Score = $25.69 \times \text{Study Time} + 0.33$
- C. Score = $0.33 \times \text{Study Time} + 25.69$
- D. Study Time = $0.33 \times \text{Score} + 25.69$
- E. Study Time = $25.69 + 0.33 \times \text{Score}$

SECTION A – continued
TURN OVER

Question 8

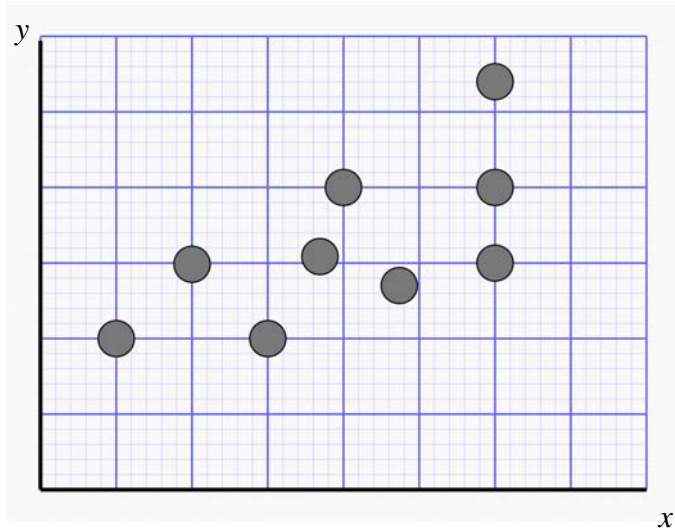
The two-way table below shows the percentages of males and females who prefer watching football and cricket.

Preference	Gender	
	Male	Female
Football	64%	27%
Cricket	36%	73%
Total	100%	100%

Which of the following statements supports the fact that there is a relationship between gender and preferred sport?

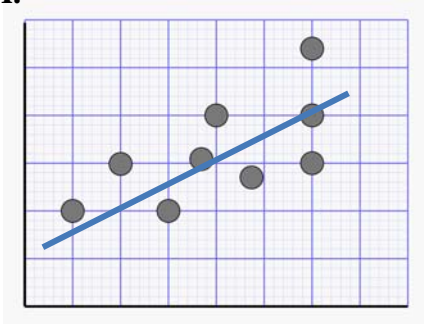
- A. Watching football is more popular among males than females.
- B. Of males, 64% of males prefer watching football and 36% prefer watching cricket.
- C. Of females, 73% prefer watching cricket and 27% prefer watching football.
- D. Overall, cricket is more popular than football.
- E. Males prefer watching football (64%), whereas females prefer watching cricket (73%).

Question 9

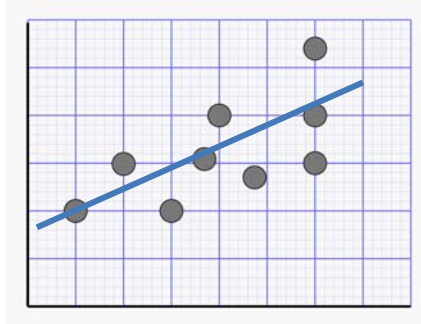


Which of the following could be the 3-median line for the scatterplot above?

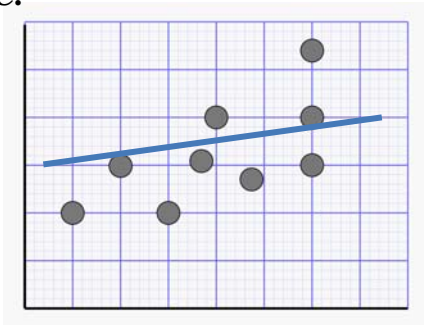
A.



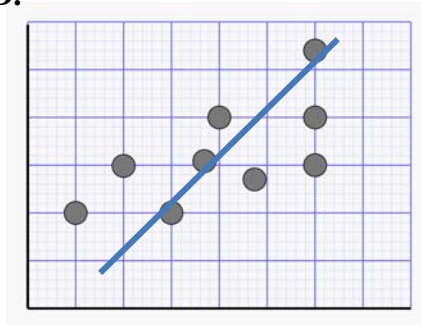
B.



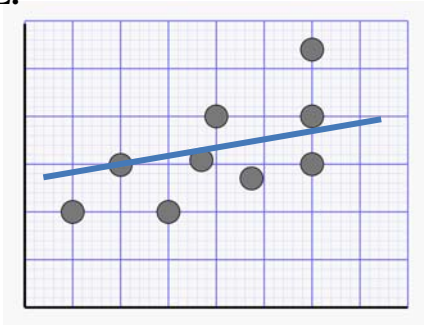
C.



D.



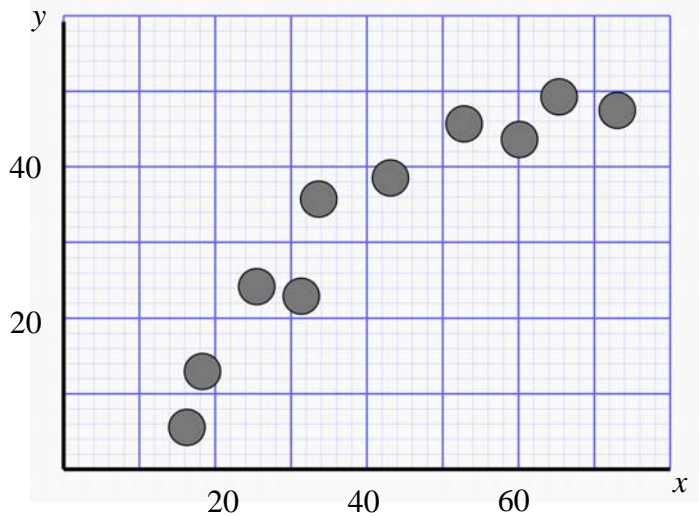
E.



SECTION A – continued
TURN OVER

Question 10

What type of transformation would be most likely to linearise the scatterplot below?



- A. x^2 or y^2
- B. $\log x$ or x^2
- C. $\frac{1}{x}$ or $\log x$
- D. $\frac{1}{y}$ or $\log x$
- E. $\log y$ or $\log x$

Use the following information to answer Questions 11 and 12.

The seasonal indices for car sales are given in the table below.

Season	Summer	Autumn	Winter	Spring
Seasonal index	1.25	x	$x + 0.2$	0.99

Question 11

The value of x is

- A. 0.80
- B. 0.78
- C. 0.88
- D. 1.00
- E. 1.08

Question 12

The least squares regression equation to calculate the number of cars sales in each quarter has been calculated using deseasonalised data. The equation is

$$\text{Deseasonalised Car Sales} = 22 \times \text{Quarter Number} + 55$$

If summer of 2013 is the 1st quarter, the predicted number of car sales for summer of 2015 is closest to

- A. 252
- B. 253
- C. 254
- D. 316
- E. 317

Question 13

The table below shows the temperatures for 7 consecutive days during January 2013.

Day	1	2	3	4	5	6	7
Temperature ($^{\circ}\text{C}$)	23	28	25	27	29	36	23

The 5-moving mean temperature, in $^{\circ}\text{C}$, for day 4 is closest to

- A. 25
- B. 27
- C. 28
- D. 29
- E. 36

**END OF SECTION A
TURN OVER**

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
Module 1: Number patterns	11
Module 2: Geometry and trigonometry	14
Module 3: Graphs and relations	19
Module 4: Business-related mathematics	26
Module 5: Networks and decision mathematics	30
Module 6: Matrices	38

Module 1: Number patterns

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

Question 1

The 2nd term of an arithmetic sequence is 9 and the 5th term is 21. What is the 7th term?

- A. 5
- B. 25
- C. 29
- D. 31
- E. 39

Question 2

For the arithmetic sequence $-2, -5, -8, -11 \dots$, the 12th term is

- A. 35
- B. 11
- C. 2
- D. -11
- E. -35

Question 3

Which of the following sequences is a geometric sequence?

- A. $2a, 4a, 6a \dots$
- B. $-9a, -3a, 3a \dots$
- C. $8a, 4a, 0 \dots$
- D. $2a - 1, a - \frac{1}{2}, \frac{a}{2} - \frac{1}{4} \dots$
- E. $\frac{a}{3}, \frac{a}{6}, \frac{a}{9} \dots$

Question 4

Annabel took her dog for a 2 km walk on Monday. She increased the distance she walked by the same amount each day. After Friday's walk, she had walked a total of 18 km.

What distance did she increase her walk by each day?

- A. 0.5 km
- B. 0.6 km
- C. 0.7 km
- D. 0.8 km
- E. 0.9 km

Question 5

What is the sum to infinity of the sequence whose terms are defined by the rule

$$t_n = 2000 \times (0.6)^n ?$$

- A. 720
- B. 1200
- C. 1800
- D. 2400
- E. 3000

Question 6

Biologists have discovered that fish numbers in Lake Macquarie change from one year to the next due to either increased numbers from breeding or reduced numbers from recreational fishing. The lake was originally stocked with 10 000 adult fish. The number of juvenile fish added each year is equal to 40% of the population of adult fish at the start of that year. Each year, 4000 fish are lost to recreational fishing.

If r_n is the population of adult fish in the lake at the start of year n , a difference equation that describes this situation is

- A. $r_{n+1} = 1.4 \times 10\,000 - 4000$
- B. $r_{n+1} = 1.4r_n - 4000$
- C. $r_{n+1} = 0.4r_n$
- D. $r_{n+1} = 0.4 \times 10\,000 - 4000$
- E. $r_{n+1} = 0.4r_n + 4000$

Question 7

The sum of the first 5 terms of an arithmetic sequence is 40 and the sum of the next 5 terms is 115. The value of the common difference is

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

Question 8

When Andy and Bridgit go to a chocolate shop together, they usually eat chocolates in the ratio of 5 for Andy to 2 for Bridgit. On Andy's birthday, they ate chocolates in the 5:2 ratio but Andy had 3 extra chocolates. Their new chocolate eating ratio became 3 for Andy to 1 for Bridgit.

On Andy's birthday, the number of chocolates eaten by Andy and Bridgit respectively, could have been

- A. 9 and 3
- B. 12 and 4
- C. 15 and 5
- D. 18 and 6
- E. Any of the above answers.

Question 9

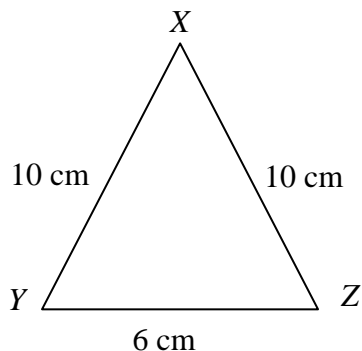
The 6th term (t_6) of the sequence $t_{n+2} = 2t_{n+1} - t_n$, where $t_1 = 4$ and $t_2 = 8$ is

- A. 16
- B. 20
- C. 24
- D. 34
- E. 58

END OF MODULE 1
SECTION B – continued
TURN OVER

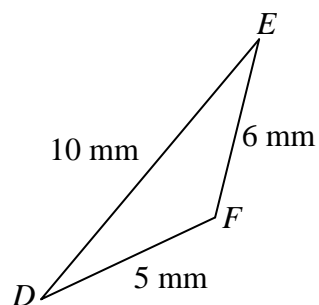
Module 2: Geometry and trigonometry

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

Question 1

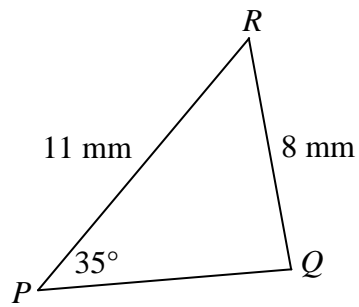
Triangle XYZ is an isosceles triangle. The angle at vertex Y is closest to

- A. 18°
- B. 36°
- C. 72°
- D. 73°
- E. 90°

Question 2

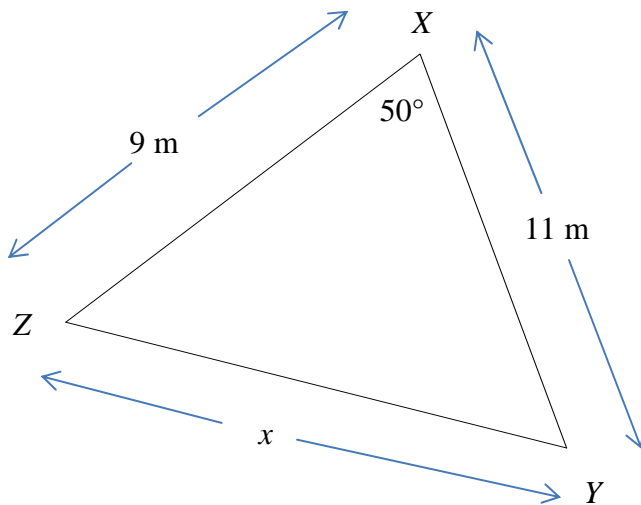
The area of the triangle DEF is closest to

- A. 11.40 mm^2
- B. 10.50 mm^2
- C. 30.00 mm^2
- D. 50.00 mm^2
- E. 129.94 mm^2

Question 3

The magnitude of the angle at vertex Q is closest to

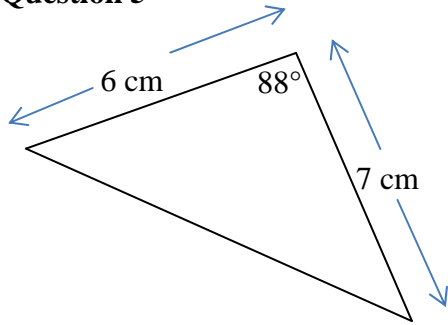
- A. 93°
- B. 35°
- C. 92°
- D. 94°
- E. 52°

Question 4

The length of side ZY is closest to

- A. 8.60 m
- B. 8.64 m
- C. 8.65 m
- D. 9.00 m
- E. 10.00 m

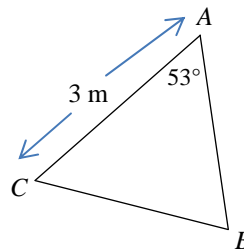
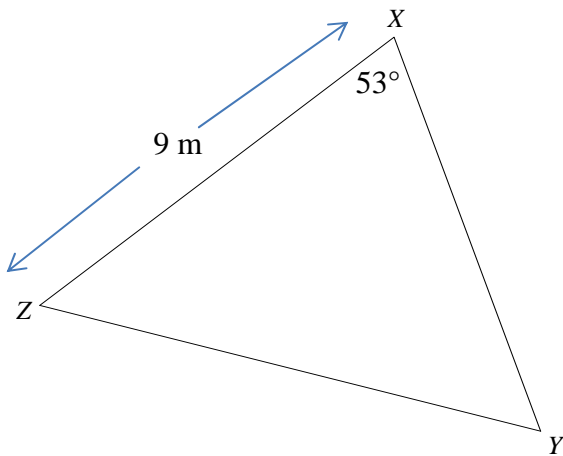
Question 5



Using the information in the above diagram, the area of the triangle is closest to

- A. 20.97 cm^2
- B. 20.98 cm^2
- C. 20.99 cm^2
- D. 21.00 cm^2
- E. 21.10 cm^2

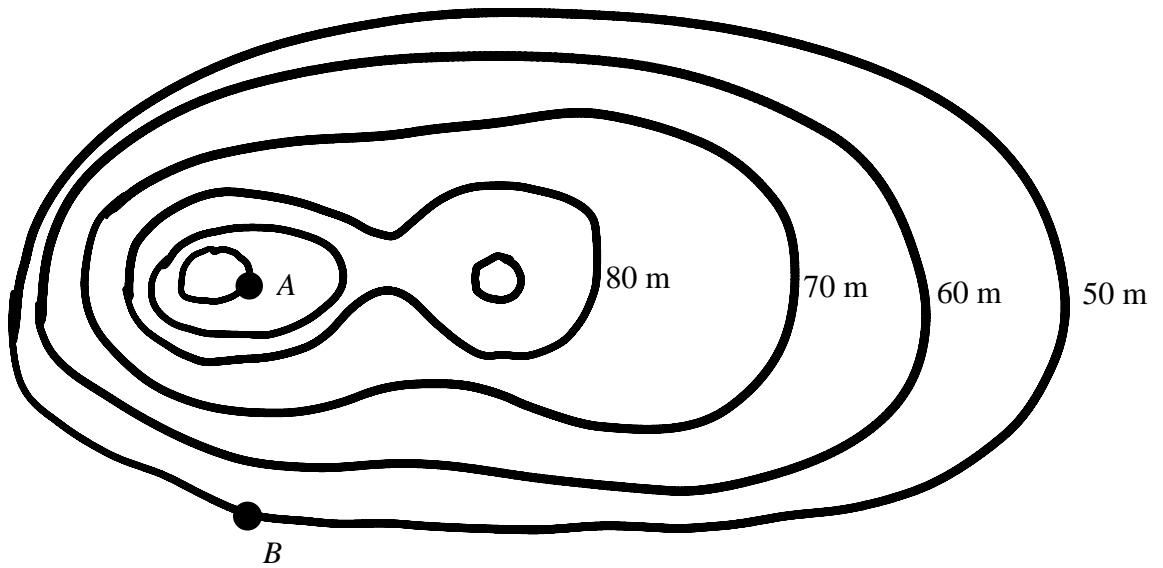
Question 6



Triangles XYZ and ABC are similar triangles. The area of triangle XYZ is 54 m^2 . The area of triangle ABC is

- A. 6 m^2
- B. 9 m^2
- C. 18 m^2
- D. 27 m^2
- E. 36 m^2

Question 7

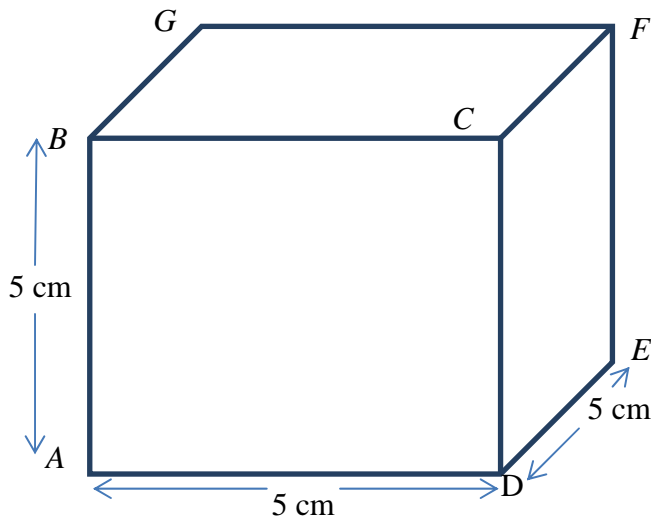


The contour map shown above has contour intervals of 10 m. The horizontal distance between points *A* and *B* is 200 m. The average slope between points *A* and *B* is

- A. $\frac{1}{8}$
- B. $\frac{1}{5}$
- C. $\frac{1}{4}$
- D. $\frac{1}{2}$
- E. 4

Question 8

The cube shown below has side lengths of 5 cm.



The distance from vertex A to vertex F is

- A. 25
- B. $\sqrt{250}$
- C. $\sqrt{50}$
- D. $3\sqrt{5}$
- E. $5\sqrt{3}$

Question 9

A scout group sets out from point A on a bearing of 100°T . A girl guides group sets out from point B on a bearing of 160°T . Point B is 10 km north-east of point A . The two groups meet up at the point, M , where their paths cross. The distances travelled by the scout group and the girl guides group, respectively, are

- A. 9.74 km and 10.65 km
- B. 10.46 km and 10.47 km
- C. 10.47 km and 10.44 km
- D. 10.47 km and 9.47 km
- E. 10.47 km and 9.46 km

Module 3: Graphs and relations

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

Question 1

The equation of the straight line joining the 2 points $(-2, -4)$ and $(8, 1)$ is

- A. $2y + x + 6 = 0$
- B. $y - 2x + 6 = 0$
- C. $y + 2x - 6 = 0$
- D. $2y - 2x - 6 = 0$
- E. $2y - x + 6 = 0$

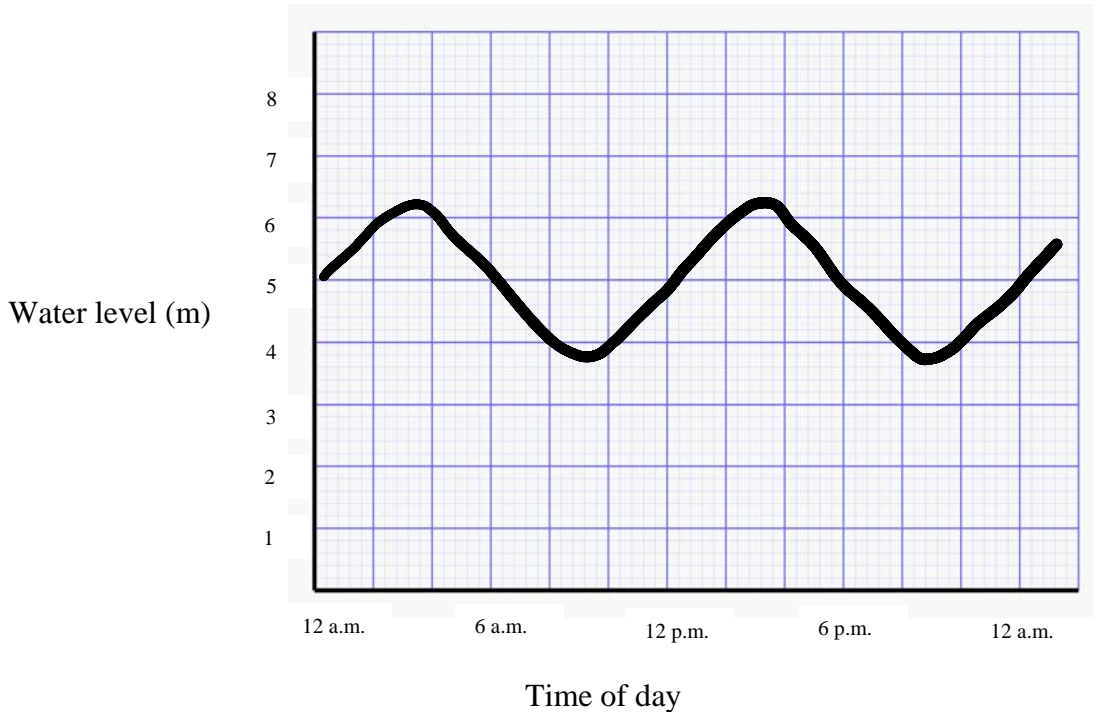
Question 2

For the pair of simultaneous equations, $y = 2x + 1$ and $2y + 3x + 12 = 0$, the solution is

- A. $(-2, 3)$
- B. $(2, -3)$
- C. $(-2, -3)$
- D. $(3, -2)$
- E. $(-3, -2)$

The following information relates to Questions 3 and 4.

The graph below shows the water level (in metres above the river bed) in the tidal Lates River at the Calcarifer Causeway.



Question 3

During the 24 hours between 12 a.m. the first day and 12 a.m. the following day, the tide is rising

- A. from 12 a.m. to 3 a.m.
- B. from 12 a.m. to 3 a.m. and from 9 a.m. to 3 p.m.
- C. from 12 a.m. to 3 a.m., from 9 a.m. to 3 p.m. and from 9 p.m. to 12 a.m.
- D. from 3 a.m. to 9 a.m. and from 3 p.m. to 9 p.m.
- E. from 3 a.m. to 9 a.m.

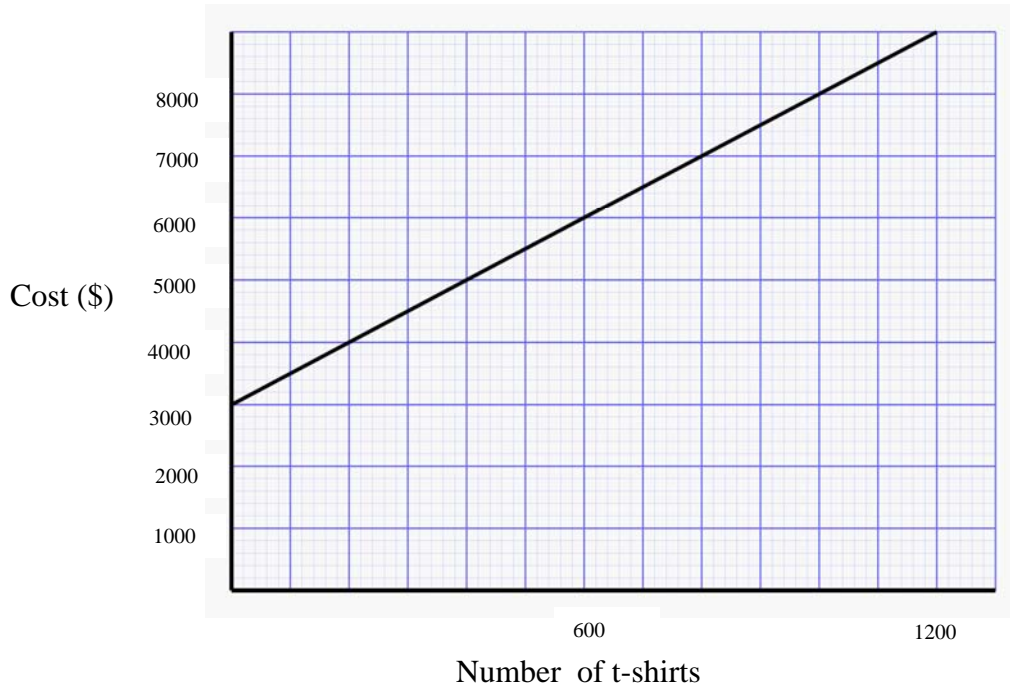
Question 4

The causeway can only be crossed safely when the water level is **no more** than 4 m above the river bed. The causeway is safe to cross each day for a total of

- A. 2 hours
- B. 4 hours
- C. 20 hours
- D. 22 hours
- E. It is never safe to cross the Calcarifer Causeway.

Question 5

The graph below is the cost function for the monthly manufacture of t-shirts at the Bwana t-shirt company.



The Bwana t-shirt company breaks even when it sells 400 t-shirts. That is, it makes a loss if it sells fewer than 400 t-shirts per month and a profit if it sells more than 400 t-shirts per month. Bwana sells t-shirts for

- A. \$8.00
- B. \$10.00
- C. \$10.50
- D. \$12.50
- E. \$15.00

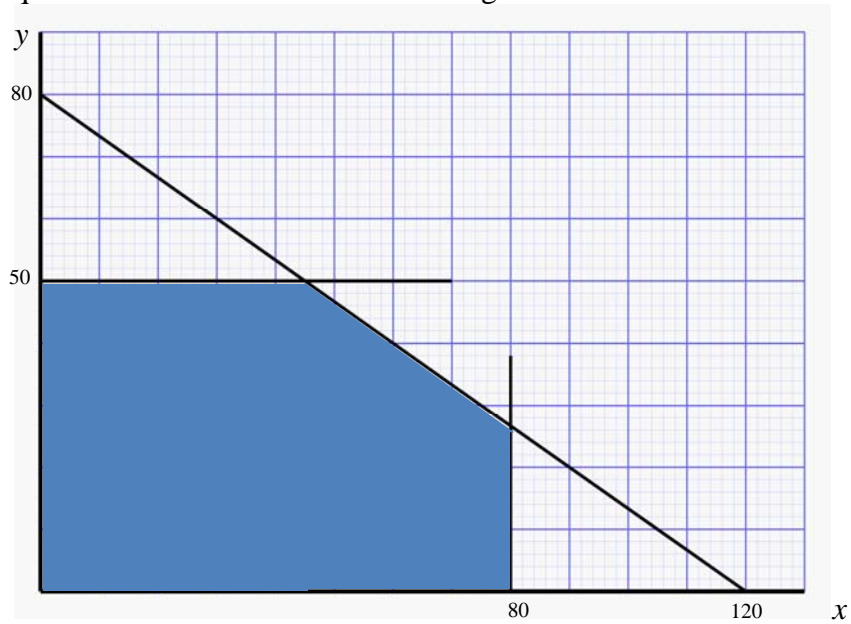
Question 6

Bernie sells fruit and vegies from his barrow at the market. He always sells apples and bananas but he cannot get more than 100 apples and more than 60 bananas from his supplier on any one day. Another limitation is that the apples and bananas combined cannot weigh more than 10 000 g. Assuming that each of his apples (a) weighs 80 g and each of his bananas (b) weighs 120 g, then the constraints that represent this situation would be

- A.**
- $$\begin{aligned} a &\leq 60 \\ b &\leq 100 \\ 120a + 80b &\leq 10\,000 \\ a &\geq 0 \\ b &\geq 0 \end{aligned}$$
- B.**
- $$\begin{aligned} a &\leq 100 \\ b &\leq 60 \\ 80a + 120b &\geq 10\,000 \\ a &\geq 0 \\ b &\geq 0 \end{aligned}$$
- C.**
- $$\begin{aligned} a &\leq 60 \\ b &\leq 100 \\ 80a + 120b &\geq 10\,000 \\ a &\geq 0 \\ b &\geq 0 \end{aligned}$$
- D.**
- $$\begin{aligned} a &\leq 100 \\ b &\leq 60 \\ 80a + 120b &\leq 10\,000 \\ a &\geq 0 \\ b &\geq 0 \end{aligned}$$
- E.**
- $$\begin{aligned} a &\geq 100 \\ b &\geq 60 \\ 120a + 80b &\leq 10\,000 \\ a &\geq 0 \\ b &\geq 0 \end{aligned}$$

Question 7

The set of inequations that describes the shaded region below is

**A.**

$$\begin{aligned} x &\leq 80 \\ y &\leq 50 \\ 3y + 2x &\leq 240 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

B.

$$\begin{aligned} x &\geq 80 \\ y &\geq 50 \\ 3y + 2x &\geq 240 \\ x &\leq 0 \\ y &\leq 0 \end{aligned}$$

C.

$$\begin{aligned} x &\leq 80 \\ y &\leq 50 \\ 2y + 3x &\leq 240 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

D.

$$\begin{aligned} x &\leq 80 \\ y &\leq 50 \\ 2y - 3x &\geq 240 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

E.

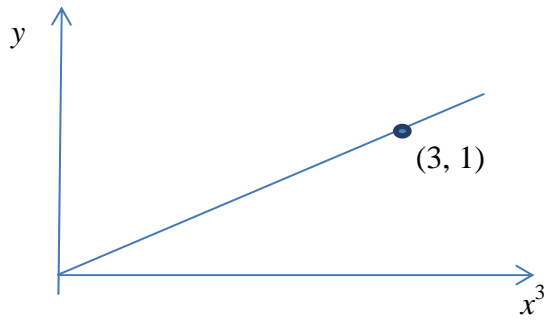
$$\begin{aligned} x &\leq 50 \\ y &\leq 80 \\ 2y + 3x &\leq 240 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

Question 8

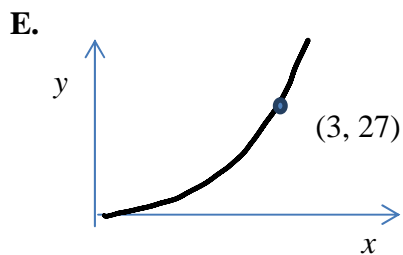
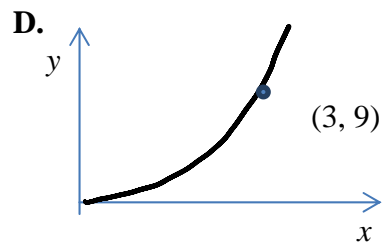
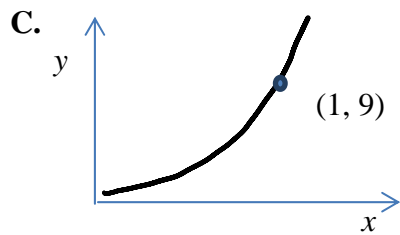
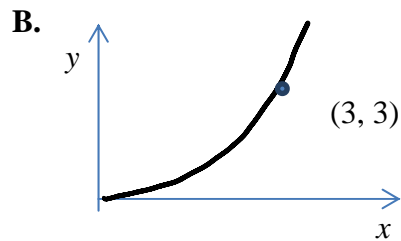
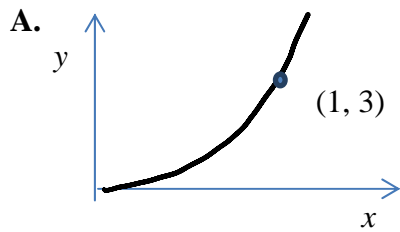
An online warehouse retailer sells 100 baseball caps for \$5 each, making a profit of \$2 per cap. The retailer has a fixed cost for selling the baseball caps, \$ x , and a \$1.50 cost for each of the caps.

The fixed cost, \$ x , is

- A. \$50
- B. \$80
- C. \$100
- D. \$120
- E. \$150

Question 9

The graph above shows the relationship between y and x^3 . The graph showing the same relationship between y and x is



END OF MODULE 3
SECTION B – continued
TURN OVER

Module 4: Business-related mathematics

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

Question 1

Wendy purchased a new MP3 player for \$214.50. A 10% GST had already been added to the price. The price before GST was added is

- A. \$19.50
- B. \$21.45
- C. \$193.05
- D. \$195.00
- E. \$235.95

Question 2

Juliette invests \$4500 in a simple interest account that earns interest at a rate of 2.7% per annum. The balance of her account after 2 years is

- A. \$121.50
- B. \$243.00
- C. \$4500.00
- D. \$4743.00
- E. \$5021.50

Question 3

Randy's car yard is desperate to sell some cars before new models arrive next week. On Tuesday, Randy reduces all vehicles by 5%. On Wednesday, the cars are reduced by a further 6%, and then on Thursday, the cars are reduced by a further 10%. The total percentage discount a customer on Friday receives compared with a customer on Monday is closest to

- A. 18%
- B. 19%
- C. 20%
- D. 21%
- E. 22%

Question 4

Regina invests \$8500 in a compound interest account that pays an interest rate of 6.2% compounding quarterly. The amount of interest earned after 5 years is closest to

- A. \$2635
- B. \$3061
- C. \$3062
- D. \$11 561
- E. \$11 562

Question 5

A bank statement for the month of July 2013 is shown below

Date	Transaction details	Credit	Debit	Balance
1 July 2013	Opening Balance			800.00
9 July 2013	Withdrawal		35.00	765.00
15 July 2013	Deposit	200.00		965.00
23 July 2013	Withdrawal		80.00	885.00
31 July 2013	Interest Deposit			

The interest on this account is calculated on the minimum daily balance at the rate of 2% per annum. The interest for the month of July is paid into the account on 31 July.

The balance after this interest payment will be closest to

- A. \$885.20
- B. \$885.25
- C. \$885.30
- D. \$886.35
- E. \$886.45

Question 6

Emily is saving up to purchase a new \$40 000 car. Her parents give her \$20 000 to start her savings account and she will be able to add \$850 each month from her income. The account is a compound interest account, compounding monthly at the rate of 5% per annum.

The number of months it will take until Emily's account has a balance of at least \$40 000 will be

- A. 20
- B. 21
- C. 22
- D. 23
- E. 24

Question 7

Harry purchases a new entertainment unit from the Henry Newman store. The advertised price is \$4500 but because he does not have much cash he agrees to a hire purchase agreement for which he pays a \$500 deposit and is required to make monthly repayments of \$200 for 3 years.

The effective interest rate is

- A. 26.7%
- B. 45.1%
- C. 53.3%
- D. 23.2%
- E. 51.9%

Question 8

Jimmy buys a new car. For 5 years, it depreciates by 20% per annum using reducing balance depreciation. After 5 years, it depreciates for another 3 years at the constant annual rate of 5% of its value at the beginning of the 6th year. After 8 years, it is valued at \$15 320.

The price of the new car is closest to

- A. \$44 000
- B. \$47 000
- C. \$51 000
- D. \$53 000
- E. \$55 000

Question 9

Edie takes out a \$200 000 reducing balance home loan. The loan is to be fully paid in monthly repayments over 20 years at an interest rate of 5% per annum. After 8 years, the bank increases the interest rate to 6.5%.

The amount by which Edie needs to increase her monthly repayment to have the loan fully repaid by the end of the 20 years is closest to

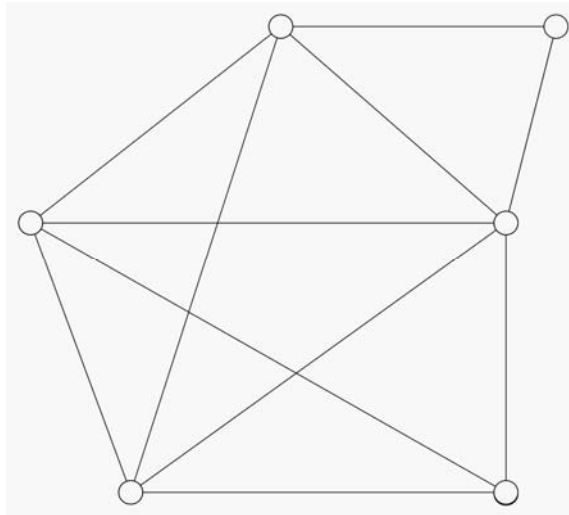
- A. \$109
- B. \$110
- C. \$1320
- D. \$1429
- E. \$1430

END OF MODULE 4
SECTION B – continued
TURN OVER

Module 5: Networks and decision mathematics

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

Question 1

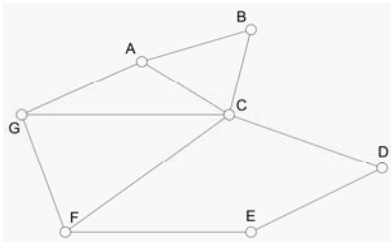
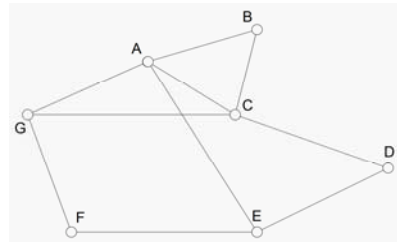
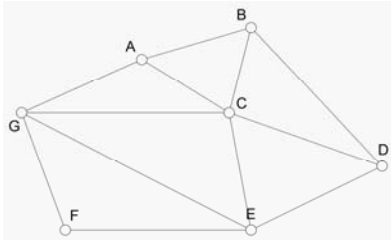
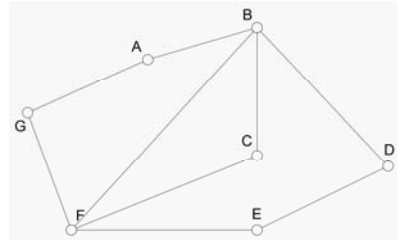
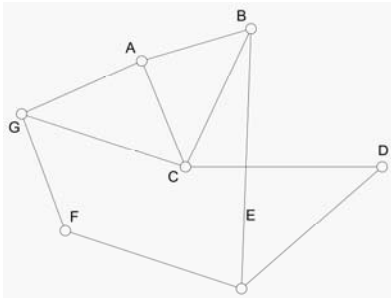


The number of faces in the network diagram above is

- A. 7
- B. 8
- C. 9
- D. 10
- E. 11

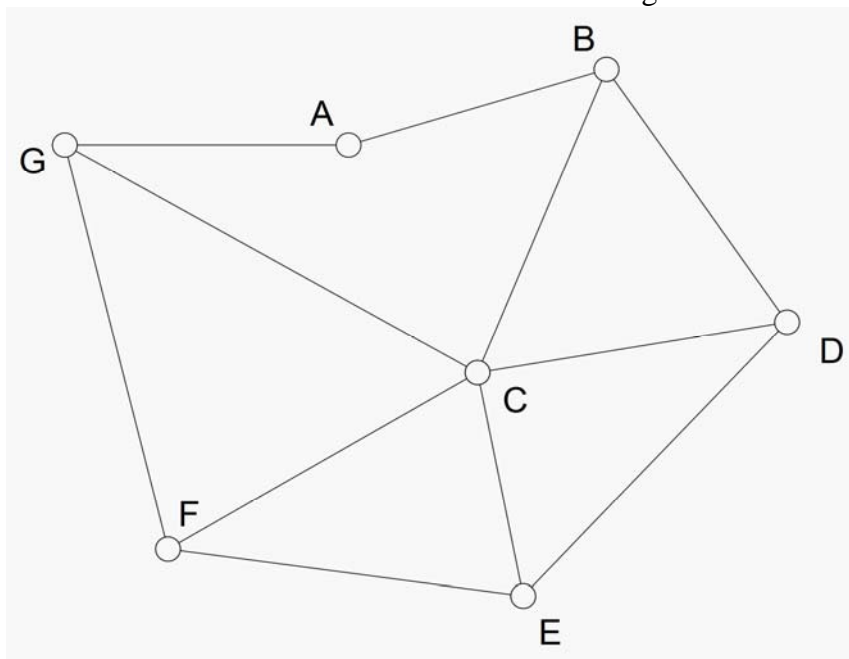
Question 2

Which one of the following graphs contains a Euler path?

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

Question 3

The network below has a Hamilton Circuit starting at vertex A.

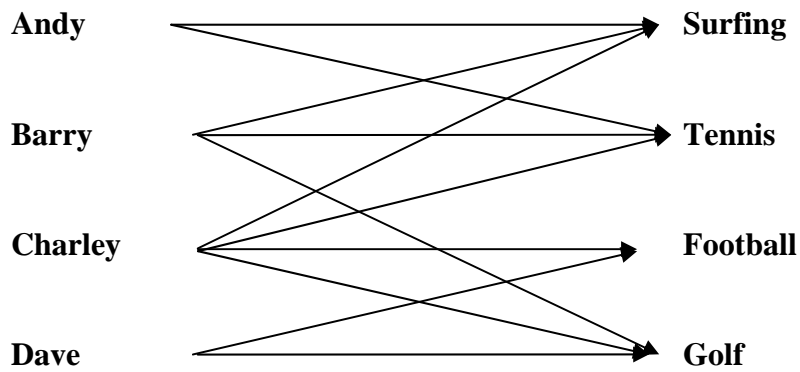


Which one of the following statements is **incorrect**?

- A. The Hamilton circuit will finish at vertex A.
- B. If the vertex after A is B, then C must be visited before G.
- C. If the vertex after A is G, then B will be last before returning to vertex A.
- D. Of the 7 vertices in the circuit, vertex E can only be 4th or 5th.
- E. Vertex C must be visited before F, E or D.

Question 4

The bipartite graph below shows the sports 4 boys like to play.



Which of the following statements is **true**?

- A. All 4 boys like surfing.
- B. Golf is more popular than tennis.
- C. Charley does not like surfing.
- D. Football is least popular.
- E. Barry likes all 4 sports.

Question 5

The table below shows the amount that each of 4 gardeners will charge per hour to do 4 different jobs.

	Aaron	Bill	Cino	Dorf
Edging	25	28	33	40
Mowing	45	40	38	43
Pruning	38	26	29	42
Weeding	32	34	38	44

To work out the best way to employ them to achieve the cheapest overall cost, Wally decides to use the Hungarian algorithm. After row reduction and then column reduction his matrix would look like

A.

	Aaron	Bill	Cino	Dorf
Edging	0	3	8	15
Mowing	7	2	0	5
Pruning	12	0	3	16
Weeding	0	2	6	12

B.

	Aaron	Bill	Cino	Dorf
Edging	0	1	5	10
Mowing	0	0	0	0
Pruning	5	0	0	11
Weeding	0	0	3	7

C.

	Aaron	Bill	Cino	Dorf
Edging	0	3	8	10
Mowing	7	2	0	0
Pruning	12	0	3	11
Weeding	0	2	6	7

D.

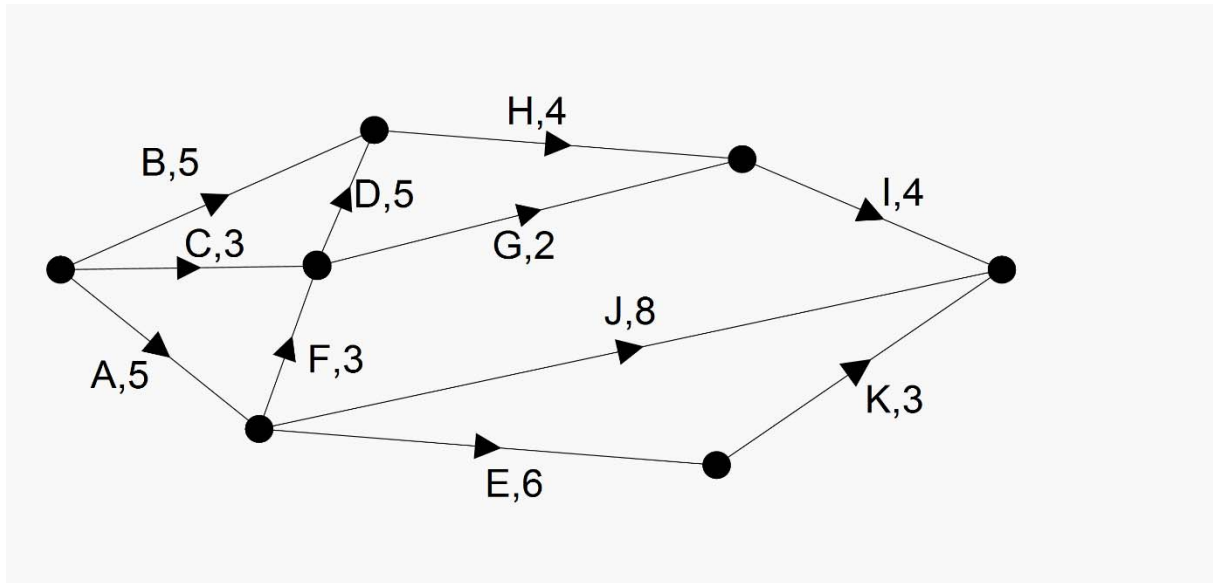
	Aaron	Bill	Cino	Dorf
Edging	0	3	8	0
Mowing	7	0	0	5
Pruning	12	0	0	16
Weeding	0	2	6	0

E.

	Aaron	Bill	Cino	Dorf
Edging	1	3	8	10
Mowing	7	2	1	1
Pruning	12	1	3	11
Weeding	0	2	6	7

Questions 6 and 7 relate to the following information.

The network diagram below shows the tasks and the number of hours that each task will take to prepare all Maths Faculty documents at Voltaire High School for the Department of Education audit.



Question 6

The shortest time in which the Maths Faculty documents at Voltaire HS can be prepared for the Department of Education audit is

- A. 9
- B. 13
- C. 19
- D. 21
- E. 48

Question 7

Activities D and H are completed by very enthusiastic teachers who both get their tasks completed in 1 hour. This reduces the total time needed to prepare all documents for the audit. The new reduced time can be achieved even though one or more activities can be delayed by an hour (or more). These activities are

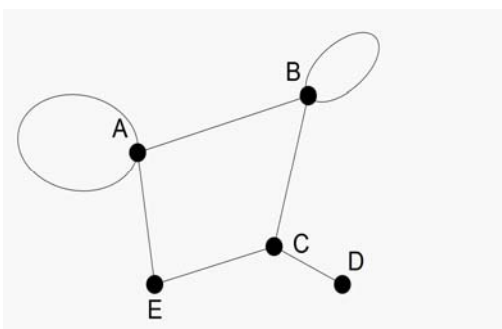
- A. G and J
- B. B and C
- C. B, C, G and J
- D. B, C, E, G, J and K
- E. A, B, C, E, F, G, I and K

Question 8

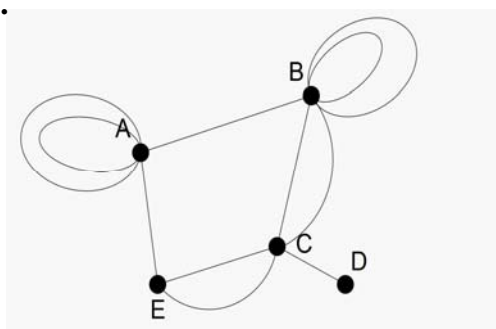
$$\begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 2 & 0 & 0 \\ 0 & 2 & 0 & 1 & 2 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 2 & 0 & 0 \end{bmatrix}$$

The graph for the above adjacency matrix is

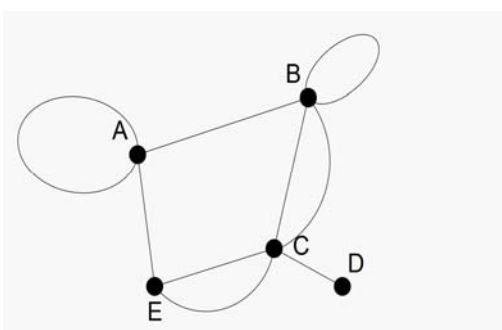
A.



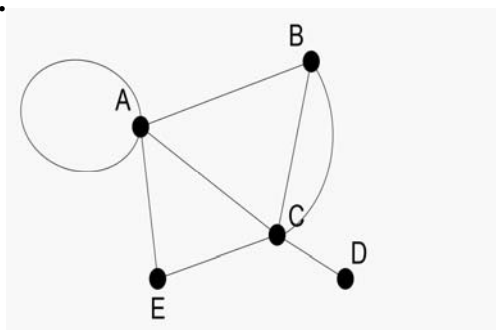
B.



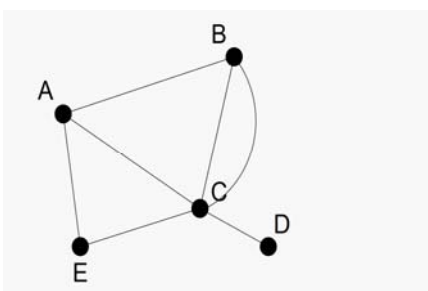
C.



D.



E.



Question 9

A connected planar graph has twice as many edges as it has vertices. The number of faces is always

- A. 5.
- B. the number of vertices minus 2.
- C. the same as the number of vertices.
- D. the number of vertices plus 2.
- E. impossible to determine.

END OF MODULE 5
SECTION B – continued
TURN OVER

Module 6: Matrices

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

Question 1

If matrix $A = \begin{bmatrix} 5 & 0 \\ 1 & 0 \\ -4 & 0 \\ 4 & 0 \end{bmatrix}$ and matrix $B = \begin{bmatrix} 0 & 0 & 0 & 0 \\ -1 & -1 & 3 & 4 \end{bmatrix}$

then the order of the matrix product AB is

- A. 1×1
- B. 1×4
- C. 2×4
- D. 2×2
- E. 4×4

Question 2

If matrix $A = \begin{bmatrix} 1 & -1 \\ 4 & -2 \end{bmatrix}$ and matrix $B = \begin{bmatrix} 3 & 4 \\ -2 & -1 \end{bmatrix}$

then $A - 2B$ is

- A. $\begin{bmatrix} -2 & -5 \\ 6 & -1 \end{bmatrix}$
- B. $\begin{bmatrix} -5 & -9 \\ 8 & 0 \end{bmatrix}$
- C. $\begin{bmatrix} 7 & 7 \\ 0 & -4 \end{bmatrix}$
- D. $\begin{bmatrix} 4 & 3 \\ 2 & -3 \end{bmatrix}$
- E. $\begin{bmatrix} 1 & 6 \\ -10 & 3 \end{bmatrix}$

Question 3

Julie buys 3 apples, 2 bananas and 1 coconut for \$8.90. Johnny buys 2 coconuts and 3 bananas for \$7.60. James buys 5 bananas and 2 apples for \$9.00. This information can be represented by the matrix equation

A.
$$\begin{bmatrix} 3 & 2 & 1 \\ 0 & 3 & 2 \\ 2 & 5 & 0 \end{bmatrix} \times \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 8.90 \\ 7.60 \\ 9.00 \end{bmatrix}$$

B.
$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 3 & 2 & 1 \\ 0 & 3 & 2 \\ 2 & 5 & 0 \end{bmatrix} \times \begin{bmatrix} 8.90 \\ 7.60 \\ 9.00 \end{bmatrix}$$

C.
$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 8.90 \\ 7.60 \\ 9.00 \end{bmatrix} \times \begin{bmatrix} 3 & 2 & 1 \\ 0 & 3 & 2 \\ 2 & 5 & 0 \end{bmatrix}^{-1}$$

D.
$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} \times \begin{bmatrix} 8.90 \\ 7.60 \\ 9.00 \end{bmatrix} = \begin{bmatrix} 3 & 2 & 1 \\ 0 & 3 & 2 \\ 2 & 5 & 0 \end{bmatrix}$$

E.
$$\begin{bmatrix} 3 & 2 & 1 \\ 0 & 3 & 2 \\ 2 & 5 & 0 \end{bmatrix}^{-1} \times \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} 8.90 \\ 7.60 \\ 9.00 \end{bmatrix}$$

Question 4

After the first week of school in 2014, all new school text books are reduced by 15%, clothing is reduced by 25% and school shoes are reduced by 18%. If matrix P represents the prices of books (B), clothing (C) and shoes (S) before the price reductions such that

$$P = [B \ C \ S]$$

then the new prices would be

A. $P \times \begin{bmatrix} 0.85 \\ 0.75 \\ 0.82 \end{bmatrix}$

B. $P \times [0.85 \ 0.75 \ 0.82]$

C. $P \times \begin{bmatrix} 0.85 & 0 & 0 \\ 0 & 0.75 & 0 \\ 0 & 0 & 0.82 \end{bmatrix}$

D. $P \times \begin{bmatrix} 0.85 & 0 & 0 \\ 0.75 & 0 & 0 \\ 0.82 & 0 & 0 \end{bmatrix}$

E. $P \times \begin{bmatrix} 0.85 & 0.75 & 0.82 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

Question 5

If matrix $A = \begin{bmatrix} -2 & -2 \\ 4 & 4 \end{bmatrix}$, which of the following statements is true?

- A. A^{-1} is a singular matrix.
- B. A^{-1} is the inverse of A .
- C. A^{-1} is undefined as $\det(A)$ is undefined.
- D. A^{-1} is zero.
- E. A^{-1} is undefined because $\det(A)$ is zero.

Question 6

How many of the following pairs of simultaneous equations do not have a unique solution?

$2x + 3y = 8$

$2x - 3y = -8$

$2x + 3y = -8$

$3x - 2y = -8$

$2x + 3y = -8$

$2x + 3y = 8$

$3x - 2y = 8$

$3x + 2y = 8$

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

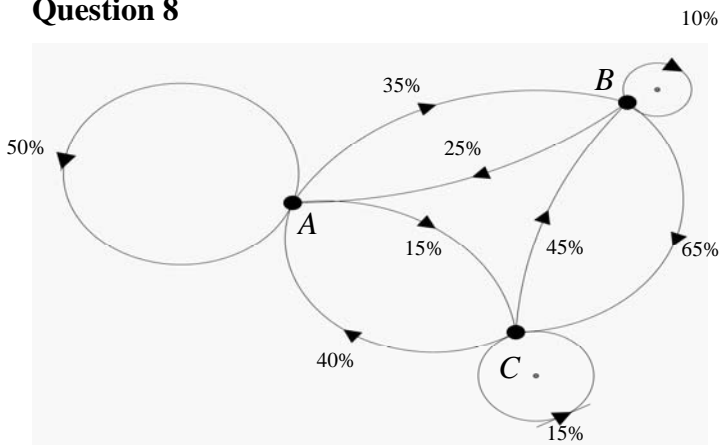
Question 7

There are 2 popular fishing spots at Torquay, the reef location (*R*) and the sand location (*S*). Of people who fish at the reef location one day, 80% fish at the sand location the next day. Of people who fish at the sand location one day, 90% will fish at the reef location the next day. On Monday, 10 people fish at the reef location and 8 fish at the sand location.

Assuming that all 18 people fish on Monday, Tuesday, Wednesday and Thursday, how many people fish at the reef location on Thursday?

- A. 7
- B. 9
- C. 9.3
- D. 9.4
- E. 10

Question 8



The diagram above represents the movement of *Myrmecia* ants between 3 ant holes (*A*, *B* and *C*) each hour on a sunny day. At midday, when the sun comes out, there are 300 ants at hole *A*, 200 at hole *B* and 500 at hole *C*.

When the sun goes behind a cloud at 4.00 p.m., the number of ants at hole *A* is

- A. 300
- B. 388
- C. 393
- D. 395
- E. 396

Question 9

If A is a 2×2 identity matrix, B is a 2×1 matrix where e_{11} is double e_{21} , $C = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

and $(A \times B) + C = \begin{bmatrix} 6 \\ 3 \end{bmatrix}$ then B is

A. $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

C. $\begin{bmatrix} 2 \\ 4 \end{bmatrix}$

D. $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$

E. $\begin{bmatrix} 4 \\ 8 \end{bmatrix}$

END OF MULTIPLE-CHOICE QUESTION BOOK