2009

VCE

Further Mathematics

Trial Examination 1

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VICTORIAN CERTIFICATE OF EDUCATION 2009

FURTHER MATHEMATICS

Trial Written Examination 1 (Facts, skills and applications)

Reading time: 15 minutes
Total writing time: 1 hour 30 minutes

MULTIPLE-CHOICE QUESTION BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of modules*	*Number of modules to be answered*	*Number of marks*
A	13	13			13
B	54	27	6	3	27
					Total 40

- Students are permitted to bring into the exam 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 book of 42 pages.
- Answer sheet for multiple-choice questions.
- There is a sheet of miscellaneous formula supplied.
- Working space is provided throughout the book.

Instructions

- Detach the formula sheet from the book during reading time.
- Check that your **name and student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the 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 room.

VCE FURTHER MATHEMATICS 2009
Trial Written Examination 1
ANSWER SHEET

NAME: _____

STUDENT NUMBER _____

SIGNATURE_____

Instructions

- Write your name in the space provided above.
- Write your student number in the space provided above. Sign your name.
- Use a **PENCIL** for **ALL** entries.
  If you make a mistake, **ERASE** it - **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- All answers must be completed like **THIS** example.

A	B	C	D	E

VCE FURTHER MATHEMATICS 2009
Trial Written Examination 1
ANSWER SHEET

NAME: _____

STUDENT NUMBER _____

SIGNATURE_____

Instructions

- Write your name in the space provided above.
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- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- All answers must be completed like **THIS** example.

A	B	C	D	E

Section A

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E

Please turn over . . .

VCE FURTHER MATHEMATICS 2009
Trial Written Examination 1
ANSWER SHEET

Section B
(Shade the boxes of the three modules selected. There are a total of six from which to choose)

	Module 1	**1**	A	B	C	D	E
		2	A	B	C	D	E
	Number patterns	**3**	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
	Module 2	**1**	A	B	C	D	E
		2	A	B	C	D	E
	Geometry and trigonometry	**3**	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
	Module 3	**1**	A	B	C	D	E
		2	A	B	C	D	E
	Graphs and relations	**3**	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E

Please turn over . . .

VCE FURTHER MATHEMATICS 2009
Trial Written Examination 1
ANSWER SHEET

Section B
(Shade the boxes of the three modules selected. There are a total of six from which to choose)

☐	**Module 4** **Business-related mathematics**	**1**	A	B	C	D	E
		2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
☐	**Module 5** **Networks and decision mathematics**	**1**	A	B	C	D	E
		2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
☐	**Module 6** **Matrices**	**1**	A	B	C	D	E
		2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E

Please DO NOT fold, bend or staple this form

FURTHER MATHEMATICS

Written examinations 1 and 2

FORMULA SHEET

Directions to students

Detach this formula sheet during reading time.

This formula sheet is provided for your reference.

Further Mathematics Formulas

Core: Data analysis

standardised score: $z = \frac{x - \bar{x}}{s_x}$

least squares line: $y = a + bx$ where $b = r\frac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$

residual value: residual value = actual value – predicted value

seasonal index: $\text{seasonal index} = \frac{\text{actual figure}}{\text{deseasonalised figure}}$

Module 1: Number patterns

arithmetic series: $a + (a+d) + ... + (a+(n-1)d) = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}(a+l)$

geometric series: $a + ar + ar^2 + ... + ar^{n-1} = \frac{a(1-r^n)}{1-r}, r \neq 1$

infinite geometric series: $a + ar + ar^2 + ar^3 + ... = \frac{a}{1-r}, |r| < 1$

Module 2: Geometry and trigonometry

area of a triangle: $\frac{1}{2}bc\sin A$

Heron's formula: $A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{1}{2}(a+b+c)$

circumference of a circle: $2\pi r$

area of a circle: πr^2

volume of a sphere: $\frac{4}{3}\pi r^3$

surface area of a sphere: $4\pi r^2$

volume of a cone: $\frac{1}{3}\pi r^2 h$

volume of a cylinder: $\pi r^2 h$

volume of a prism: area of base × height

volume of a pyramid: $\frac{1}{3}$ area of base × height

Pythagoras' theorem: $c^2 = a^2 + b^2$

sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

cosine rule: $c^2 = a^2 + b^2 - 2ab\cos C$

Module 3: Graphs and relations

Straight line graphs

gradient (slope): $m = \frac{y_2 - y_1}{x_2 - x_1}$

equation: $y = mx + c$

Module 4: Business-related mathematics

simple interest: $I = \frac{\Pr T}{100}$

compound interest: $A = PR^n$ where $R = 1 + \frac{r}{100}$

hire purchase: effective rate of interest $\approx \frac{2n}{n+1} \times$ flat rate

annuities: $A = PR^n - \frac{Q(R^n - 1)}{R - 1}$, where $R = 1 + \frac{r}{100}$

Module 5: Networks and decision mathematics

Euler's formula: $v + f = e + 2$

Module 6: Matrices

determinant of a 2×2 matrix: $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$; $\det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

inverse of a 2×2 matrix: $A^{-1} = \frac{1}{\det A}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ where $\det A \neq 0$

END OF FORMULA SHEET

Specific Instructions for Section A

Section A consists of 13 questions
Answer **all** questions in this section.
A correct answer scores 1 mark, an incorrect answer scores 0. No mark will be given for a question if two or more letters are shaded for that question. Marks will not be deducted for incorrect answers and you should attempt every question.

Core

The following information relates to Questions 1, 2 and 3

The shoe size of a number of students is listed in the following table.

Shoe Size	Frequency
4	1
5	1
6	3
7	2
8	5
9	5
10	15
11	8
12	6
13	4

Question 1

The percentage of students with a shoe size of at least a ten is

A. 6%

B. 33%

C. 34%

D. 36%

E. 66%

Question 2

The mean shoe size is closest to

A. 8.5

B. 9

C. 9.76

D. 10

E. 10.25

Core

Question 3

The interquartile range is

A. 1

B. 2

C. 3

D. 4

E. 5

Question 4

A student conducted a survey to find the favourite tuck shop drink of three classes. The results are listed in the table below.

Year Level	Year 10	Year 11	Year 12	Total
Water		20	18	47
Cola	21	3		26
Milk		4		
Fruit Juice	10	25	17	52
Total	45		40	

The number of year 12 students who chose milk was

A. 1

B. 2

C. 3

D. 4

E. 5

Core

Question 5

Aisha's golf scores over a year are approximately normally distributed with a mean of 93 and a standard deviation of 3. The percentage of her scores that are less than 99 is approximately

A. 92.5%

B. 95%

C. 97.5%

D. 99.7%

E. 99.85%

Question 6

The mathematics exam mark of 30 students was recorded, along with their results on an aptitude test. The following statistics were determined.

Standard deviation of aptitude test = 11.9
Standard deviation of mathematics exam = 13.5
Mean of aptitude test = 69.7
Mean of mathematics exam = 72.2
Correlation Coefficient = 0.75

The gradient of the least squares regression line that will enable exam mark to be predicted from the results of the aptitude test is closest to

A. 0.13

B. 0.66

C. 0.72

D. 0.78

E. 0.85

Core

Question 7

250,000 students sat for a mathematics exam in which the results obtained were normally distributed with a mean of 52 and a standard deviation of 12. If the top 375 students were given an A grade, then the lowest mark for an A grade was

A. 75

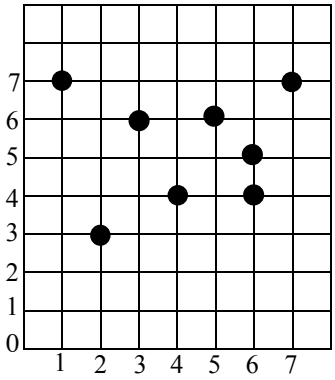
B. 76

C. 80

D. 88

E. 92

Question 8



On the above scatter plot, two points that could be used to draw a 3-median line are

A. (2, 6) and (6, 5).

B. (3, 6) and (6, 5).

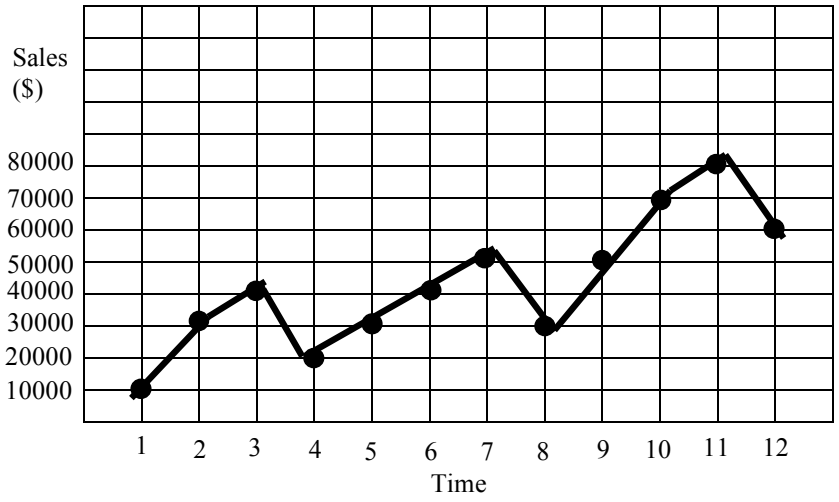
C. (2, 3) and (6, 5).

D. (3, 6) and (6, 4).

E. (2, 6) and (6, 4).

Core

The following information relates to Questions 9 and 10



Question 9

The above time series graph shows sales over three years. It is best described as showing

A. trend only

B. random variation

C. seasonal variation only

D. cyclical variation with trend

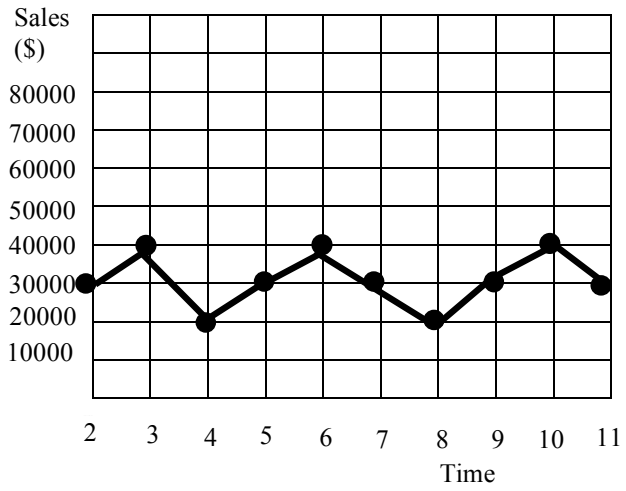
E. seasonal variation with trend

Core

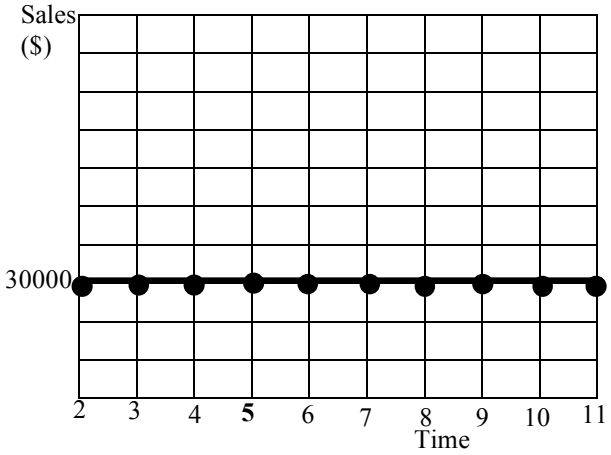
Question 10

When smoothed using 3-point median smoothing, the time series plot will look like

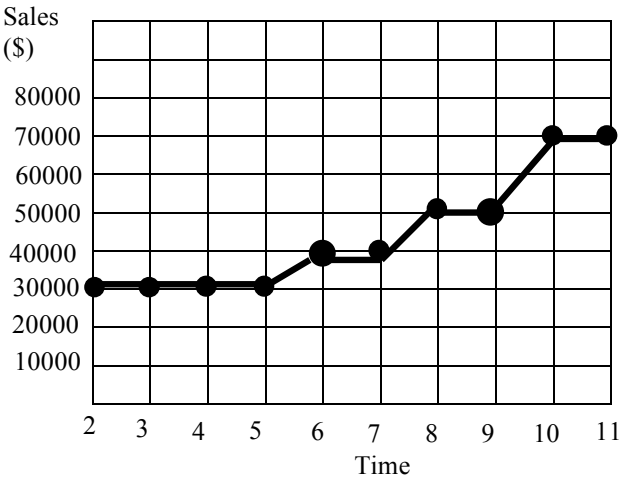
A.



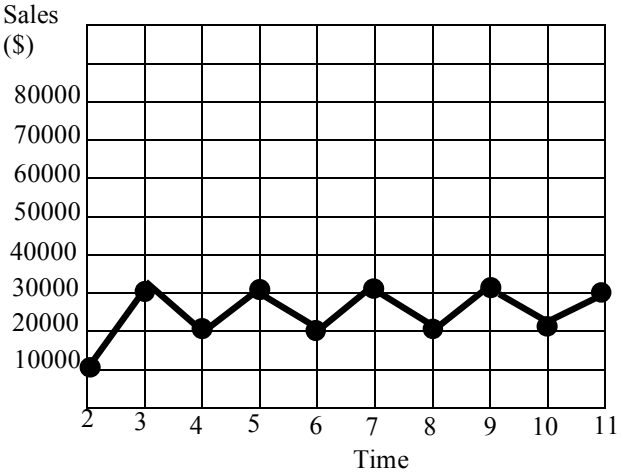
B.



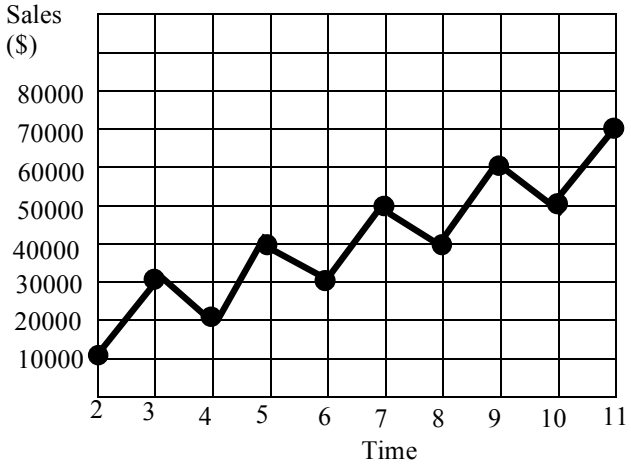
C.



D.



E.



Core

Question 11

If, for a sample of students, 85% of the variation in the hours they spent doing homework can be explained by the variation in the hours they spent watching television, then which one of the following statements must be true?

A. A strong positive correlation exists between the two variables.

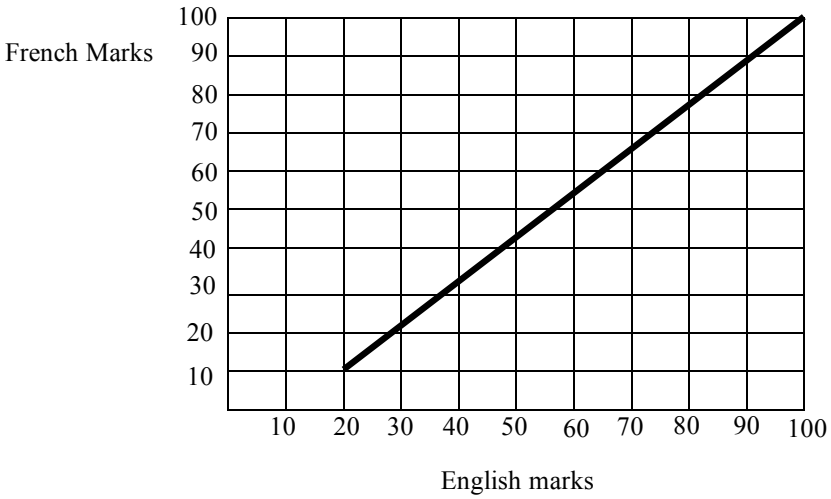
B. Pearson's correlation coefficient must be greater than 0.85

C. The least squares regression line has a negative gradient

D. The slope of the least squares regression line is 0.92

E. Time spent watching television is the independent variable.

Question 12



The graph above shows the line of best fit for the results of a group of students studying both French and English. This graph predicts that

A. for an increase of one mark in French there will be an increase of 1.125 marks in English.

B. for an increase of one mark in English there will be an increase of 1.125 marks in French.

C. students never score the same marks for French and English.

D. there is a strong negative correlation between the English and French marks.

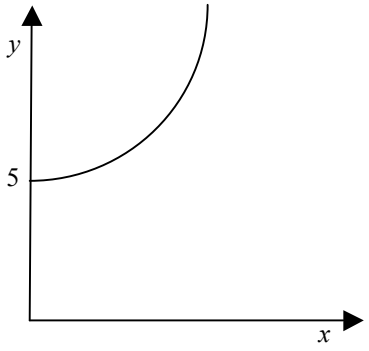
E. for an increase of 20 marks in English there will be an increase of 10 marks in French.

Core

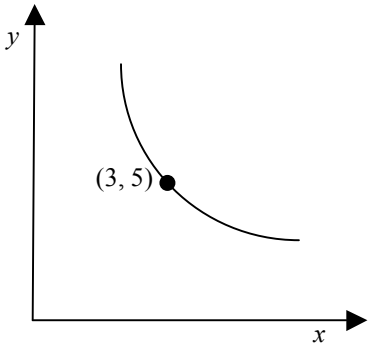
Question 13

Which one of the following graphs best describes the relationship $y = 3\log x + 5$

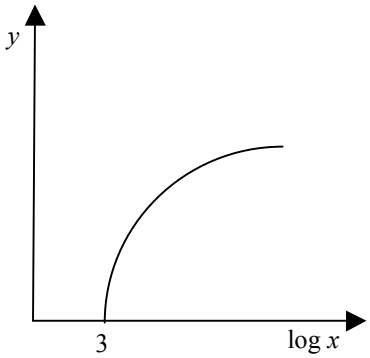
A.



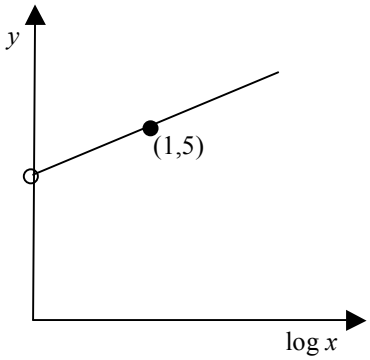
B.



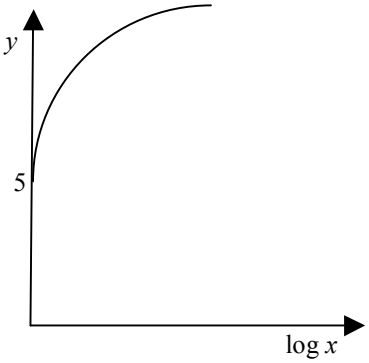
C.



D.



E.



END OF SECTION A

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 mark, 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.

Module		**Page**
Module 1:	Number patterns	10
Module 2:	Geometry and trigonometry	15
Module 3:	Graphs and relations	20
Module 4:	Business-related mathematics	27
Module 5:	Networks and decision mathematics	32
Module 6:	Matrices	38

Module 1: Number patterns and applications

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

Question 1

The difference equation for the sequence 3, 6, 12, 24,….. is

A. $t_n = 2t_{n-1} \quad t_1 = 1$

B. $t_n = 2t_{n-1} \quad t_1 = 3$

C. $t_n = t_{n-1} + 3 \quad t_1 = 3$

D. $t_n = t_{n-1} + 3 \quad t_1 = 1$

E. $t_n = 2t_{n-1} + 3 \quad t_1 = 3$

Question 2

If $A_{n+1} = 0.97A_n$ then which one of the following statements could be true?

A. The amount in any year is equal to 97% of the amount the following year.

B. The amount each year increases by 3%.

C. The amount each year is 3% less than the amount the year before.

D. The amount each year increases by 97%.

E. The amount each year decreases by 97%.

Module 1: Number patterns and applications

Question 3

The sum of 0.3 + 0.03 + 0.003 + …. is

A. $\frac{1}{3}$

B. $\frac{1}{30}$

C. $\frac{1}{10}$

D. $\frac{1}{100}$

E. $\frac{3}{10}$

Question 4

The sum of the first fifteen terms of the sequence, 4, -8, 16, -32, 64….. is

A. 43692

B. -10922

C. -131072

D. -21844

E. -43689

Module 1: Number patterns and applications

Question 5

Each year, the value of an article decreases by 6% of its value at the beginning of the year. If the original value was \$5,000, after how many years will the value first be less than \$2,000?

A. 13

B. 14

C. 15

D. 16

E. 17

Question 6

If $S_n = an^2 - bn$, then $S_{n+1} - S_n$ equals

A. $2an - 2bn - a + b$

B. $2an - 2bn + a + b$

C. $2an + a + b$

D. $2an + a - b$

E. $2an + 2bn + a - b$

Module 1: Number patterns and applications

Question 7

The population of bats in a certain suburb increases by 15% per year. At the end of each year 10 bats are relocated to a new island sanctuary. If the population of bats at the beginning of the year 2005 is 2000, then in which year will the population reach 6000?

A. 2013

B. 2014

C. 2015

D. 2016

E. 2017

Question 8

If $t_n = t_{n-1} + t_{n-2}$ where $t_1 = t_2 = 1$,
then the first term to be greater than 20,000 is term

A. 22

B. 23

C. 24

D. 25

E. 26

Module 1: Number patterns and applications

Question 9

If the sixth term of an arithmetic sequence is double the third term and the sum of the first twelve terms is 234, then the common difference is

A. 2

B. 3

C. 4

D. 5

E. 6

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

An isosceles triangle ABC has $AB = 10$ and $AC = 4$.
The perimeter of this triangle could be

A. 18

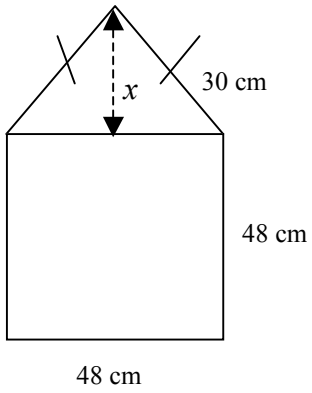
B. 20

C. 24

D. 28

E. 40

Question 2



The value of x in the above diagram is

A. 9 cm.

B. 12 cm.

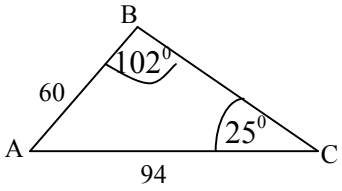
C. 18 cm.

D. 24 cm.

E. 78 cm.

Module 2: Geometry and trigonometry

Question 3



In the above triangle, the value of BC is equal to

A. $\dfrac{60\sin 53^0}{\sin 25^0}$

B. $\dfrac{60\sin 102^0}{\sin 25^0}$

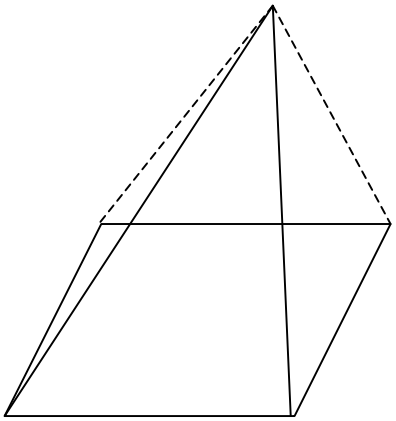
C. $\dfrac{94\sin 25^0}{\sin 102^0}$

D. $\dfrac{60}{\sin 25^0 \sin 53^0}$

E. $\dfrac{94}{\sin 25^0 \sin 102^0}$

Module 2: Geometry and trigonometry

Question 4



A right square pyramid has a base length of 12 cm. and a height of 16.2 cm.
The angle between the sloping face and the base is closest to

A. 21^0

B. 22^0

C. 68^0

D. 69^0

E. 70^0

Question 5

A map has a scale of 1:200000
What distance on the map would represent 40 km?

A. 20 cm

B. 2 m

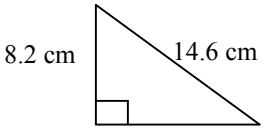
C. 0.5 m

D. 5 m

E. 50 cm

Module 2: Geometry and trigonometry

Question 6



The area of this triangle in cm^2 is closest to

A. 12.2

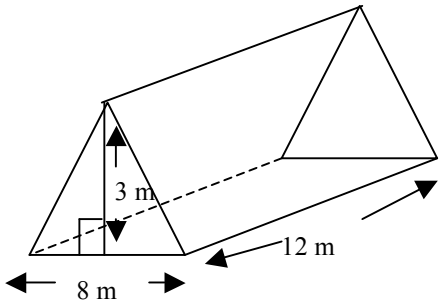
B. 20.4

C. 49.5

D. 56.2

E. 59.8

Question 7



The surface area of the above triangular prism in m^2 is

A. 96

B. 180

C. 192

D. 226

E. 240

Module 2: Geometry and trigonometry

Question 8

The diameter of an original cylinder is x cm. and the length of the cylinder is y cm. If the diameter is doubled and the length is halved to make a second cylinder, then which **one** of the following statements is true?

A. The volume of the second cylinder will be half the volume of the original cylinder.

B. The volume of the second cylinder will be double the volume of the original cylinder.

C. The volume of the second cylinder will be a quarter of the volume of the original cylinder.

D. The volume of the second cylinder will be four times the volume of the original cylinder.

E. The volume of the second cylinder will be eight times the volume of the original cylinder.

Question 9

Mymy leaves home and cycles 15 km to her music lesson on a bearing of 130^0. She then cycles at 24 km/hr for 20 minutes on a bearing of 200^0 to get to her friend's house. The distance the friend's house is from Mymy's house is closest to

A. 12.4 km

B. 13.0 km

C. 14.4 km

D. 17.2 km

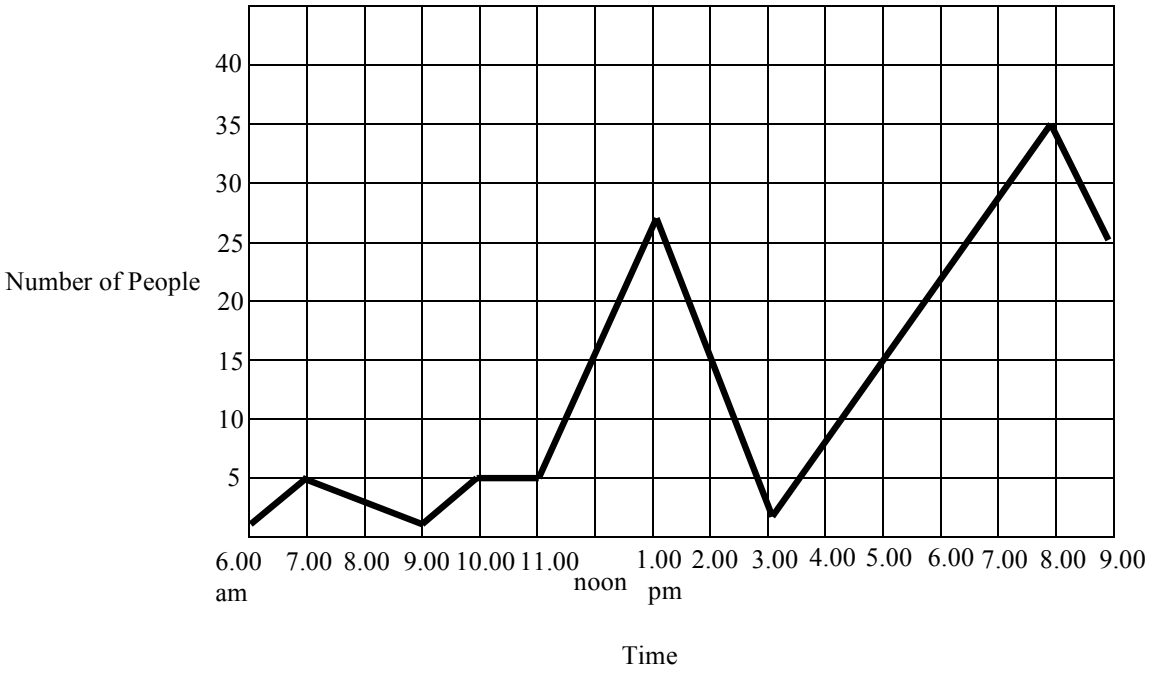
E. 19.3 km

End of Module 2

Module 3: Graphs and relations

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

Question 1



The above graph shows the number of people entering a take-away shop between 6.00 am and 9.00 pm. The number of hours that there were more than 15 people entering the shop is closest to

A. 2

B. 3

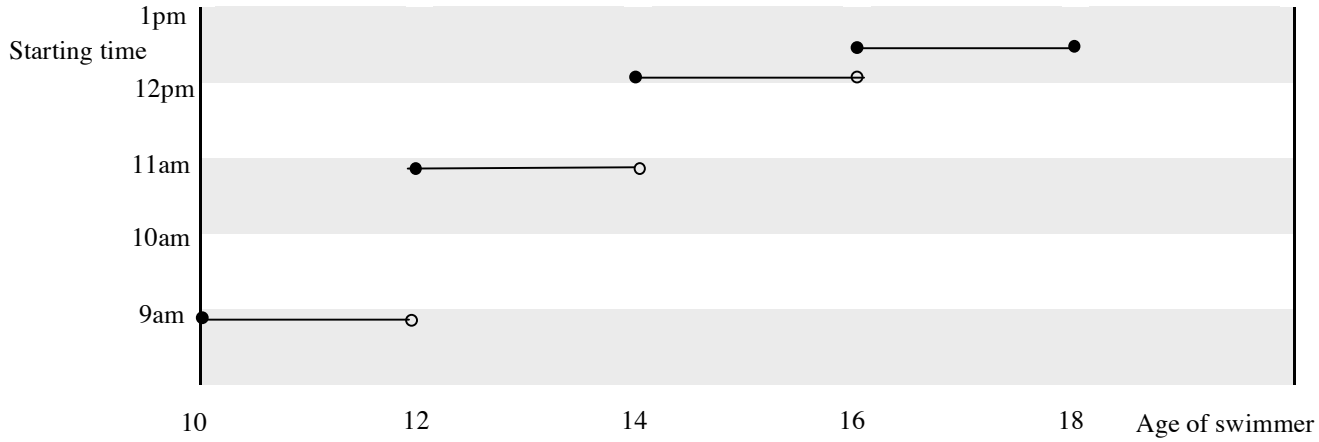
C. 5

D. 6

E. 8

Module 3: Graphs and relations

Question 2



The above graph shows the times for various events at an interschool swimming competition.
Which one of the following statements is **true**?

A. 13 and 14 year old students have the same start time.

B. 16 year old students start at 1.00 pm

C. All start times cater for two age groups.

D. All start times cater for three age groups

E. The number of different age groups that swim before 12.00pm is 4

Question 3

A car company charges $50 per day to hire a car and then $30 per kilometer travelled. Guy hires a car for 7 days and travels x km. The equation showing his total cost is

A. $C = 50 + 30x$

B. $C = 30x - 50$

C. $C = 30x + 350$

D. $C = 210x + 350$

E. $C = 210x + 50$

Module 3: Graphs and relations

Question 4

If $2x + 3y = 18$ and $5x - 2y = 26$,
then $3x + 5y$ equals

A. 8

B. 10

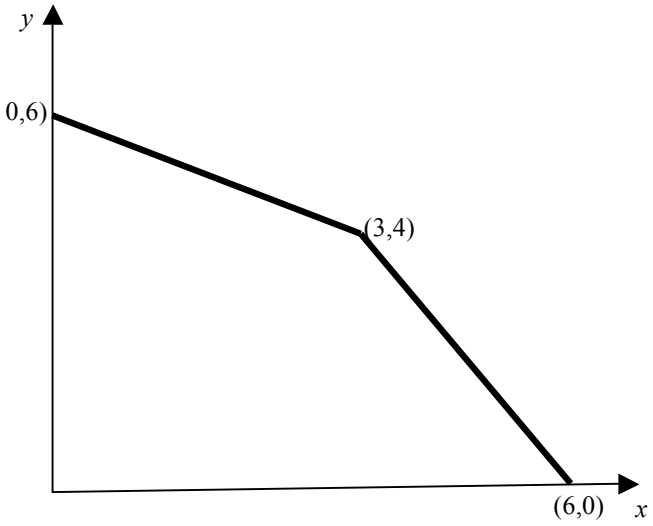
C. 24

D. 28

E. 44

Module 3: Graphs and relations

Question 5



The line segment graph above represents the function with the rule

A. $y = \begin{cases} -\frac{2}{3}x+6 & 0 \le x \le 3 \\ -\frac{4}{3}x+8 & 3 < x \le 6 \end{cases}$

B. $y = \begin{cases} \frac{2}{3}x+6 & 0 \le x \le 3 \\ -\frac{4}{3}x+8 & 3 < x \le 6 \end{cases}$

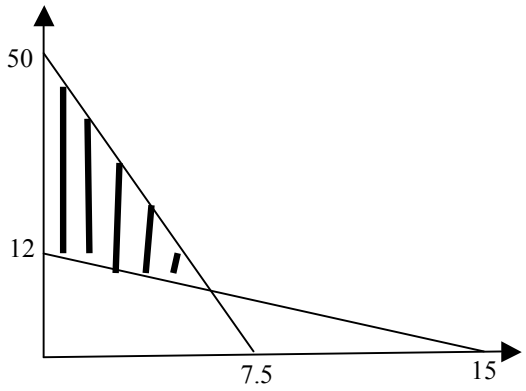
C. $y = \begin{cases} \frac{2}{3}x & 0 \le x \le 3 \\ \frac{4}{3}x+8 & 3 < x \le 6 \end{cases}$

D. $y = \begin{cases} -\frac{3}{2}x+6 & 0 \le x \le 3 \\ -\frac{1}{2}x+8 & 3 < x \le 6 \end{cases}$

E. $y = \begin{cases} -\frac{3}{4}x+6 & 0 \le x \le 3 \\ -\frac{1}{2}x+8 & 3 < x \le 6 \end{cases}$

Module 3: Graphs and relations

Question 6



Which one of the following describes the shaded region?

A. $x \geq 0, \quad 4x + 5y \geq 60, \quad 20x + 3y \leq 150$

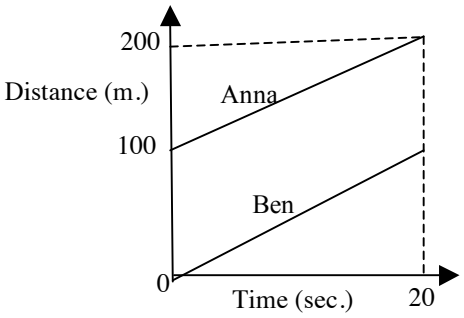
B. $x \geq 0, \quad 4x + 5y \leq 60, \quad 20x + 3y \geq 150$

C. $x \geq 0, \quad 5x + 4y \geq 60, \quad 20x + 3y \leq 150$

D. $x \geq 0, \quad 5x + 4y \leq 60, \quad 20x + 3y \geq 150$

E. $x \geq 0, \quad 4x + 5y \leq 60, \quad 2x + 6y \leq 150$

Question 7



The above graph shows the distance versus time for two runners, Anna and Ben. Anna and Ben run towards a finish line 200 m. from 0, with Ben running at a speed of 8 m/sec. Which one of the following statements is **true**?

A. Anna is given a 100m start but Ben wins.

B. Anna's speed is 10 m/sec.

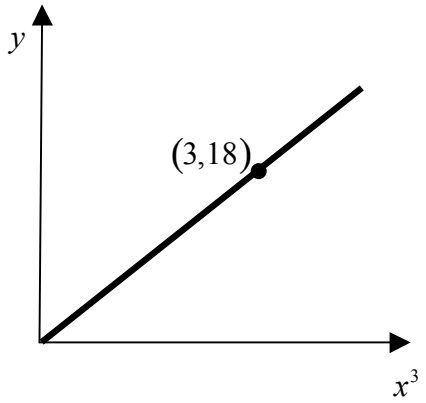
C. Ben wins by 60 m.

D. Anna is given a 100 m start and then wins by 60 m.

E. Anna wins by 40 m.

Module 3: Graphs and relations

Question 8



The rule for the above graph is

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

B. $y = \frac{1}{3}x^3$

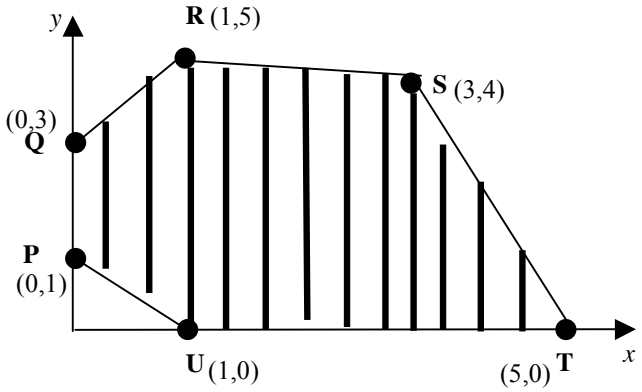
C. $y = \frac{3}{2}x^3$

D. $y = \frac{3}{5}x^3$

E. $y = 6x^3$

Module 3: Graphs and relations

Question 9



The shaded region in the above graph represents the feasible region for a linear programming problem. If the objective function is $Z = ax + y$, then the maximum value of Z will occur at point R if

A. $\frac{1}{2} < a < 2$

B. $-2 < a < \frac{1}{2}$

C. $-\frac{1}{2} < a < 2$

D. $-2 < a < -\frac{1}{2}$

E. $a < -\frac{1}{2}$

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

After a 15% depreciation over one year, May's car was valued at$12,360. The value of May's car at the beginning of this year was closest to

A. $13,000

B. $13,500

C. $14,000

D. $14,500

E. $15,000

Question 2

Aaron buys a $1,400 computer and is given an 8% discount on this price. However, he still has to pay 10% G.S.T. What is the total price he pays for the computer?

A. $1159.20

B. $1372

C. $1416.80

D. $1428

E. $1540

Module 4: Business-related mathematics

The following information relates to Questions 3 and 4

Jane buys a TV for $3,500. She agrees to pay a deposit of $500 and the balance is to be repaid in 24 monthly instalments of $160.

Question 3

The amount of interest Jane pays is

A. $340

B. $760

C. $840

D. $3000

E. $3340

Question 4

The flat rate annual interest is

A. 12%

B. 14%

C. 21%

D. 24%

E. 28%

Module 4: Business-related mathematics

Question 5

The following is a bank statement for the first quarter of 2009 for Greta Green.

Date	Deposit	Withdrawal	Balance
5/1		$200	$9360
3/2	$1100		$10460
15/2		$350	$10110
27/2		$600	$9510
8/3	$800		$10310
31/3		$200	$10110

If interest of 5% per annum is paid on the minimum monthly balance, then the total interest paid for this three month period is closest to

A. $116.80

B. $117.65

C. $120.75

D. $1416.50

E. $1449

Question 6

An office purchases a machine for $2,500. If the machine depreciates at $6\frac{1}{2}\%$ of the purchase price per annum, then the number of years it will take for the machine to reach a scrap value of $550 is

A. 11

B. 12

C. 13

D. 14

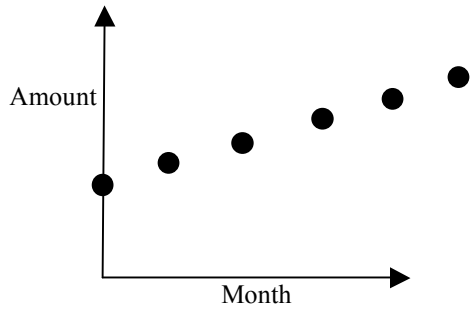
E. 15

Module 4: Business-related mathematics

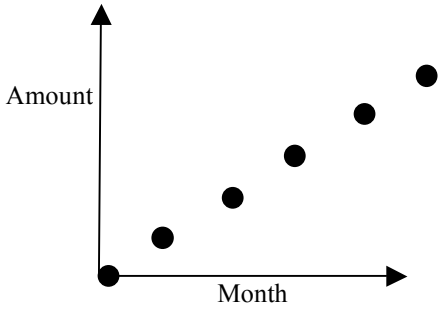
Question 7

Polly invests $25,000 at a fixed interest rate compounding monthly for six months. Which graph best represents the amount of the investment over this time?

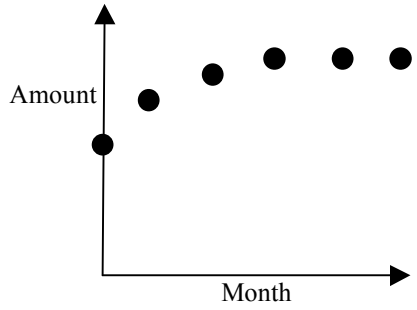
A.



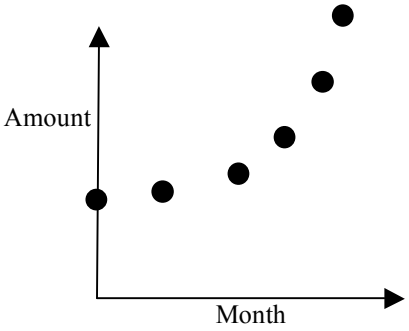
B.



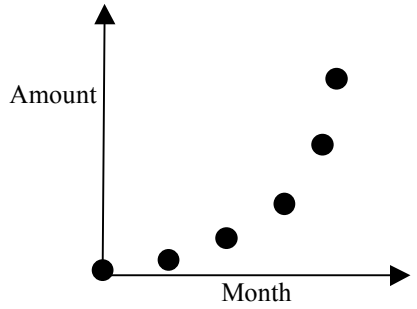
C.



D.



E.



Module 4: Business-related mathematics

Question 8

Donald takes out a home loan for $360,000 for 25 years at an interest rate of 5% per annum compounded monthly. The amount he must repay each month is closest to

A. $1263.80

B. $2104.53

C. $4610.99

D. $14465

E. $15192.97

Question 9

Aisha invested $5000 earning 4% per annum compounded monthly. The balance in dollars after 3 years will be

A. $5000\left(1+\frac{4}{100}\right)^{3}$

B. $5000\left(1+\frac{4}{100}\right)^{36}$

C. $5000\left(1+\frac{4}{300}\right)^{36}$

D. $5000\left(1+\frac{4}{300}\right)^{3}$

E. $5000\left(1+\frac{1}{300}\right)^{36}$

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

If the sum of the degrees of the vertices of a network is 26, then the number of edges of this network is

A. 6

B. 13

C. 24

D. 39

E 52

Question 2

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

A. All complete graphs have the same number of vertices as edges.

B. It is not possible for a complete graph with more than two vertices to be planar.

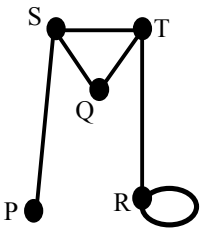
C. All complete graphs with more than two vertices have an Euler circuit.

D. All complete graphs with more than two vertices have an Euler path.

E. All complete graphs with more than two vertices have an Hamiltonian circuit.

Module 5: Networks and decision mathematics

Question 3



Which one of the following is the adjacency matrix for the above network?

A.

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \\ T \end{array}\begin{array}{c} \begin{array}{ccccc} P & Q & R & S & T \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

B.

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \\ T \end{array}\begin{array}{c} \begin{array}{ccccc} P & Q & R & S & T \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

C.

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \\ T \end{array}\begin{array}{c} \begin{array}{ccccc} P & Q & R & S & T \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

D.

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \\ T \end{array}\begin{array}{c} \begin{array}{ccccc} P & Q & R & S & T \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 2 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

E.

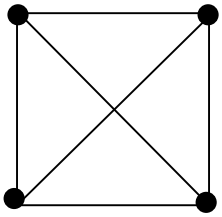
$$\begin{array}{c} \\ P \\ Q \\ R \\ S \\ T \end{array}\begin{array}{c} \begin{array}{ccccc} P & Q & R & S & T \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 2 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

Module 5: Networks and decision mathematics

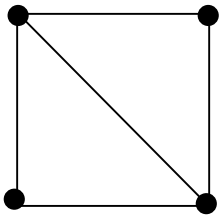
Question 4

Which one of the following does not have an Euler path?

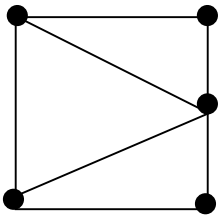
A.



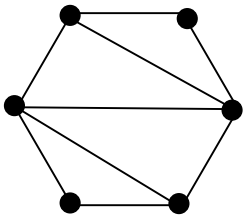
B.



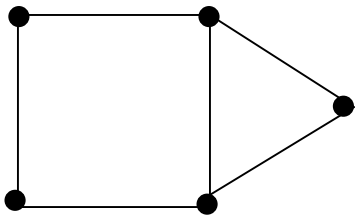
C.



D.



E.

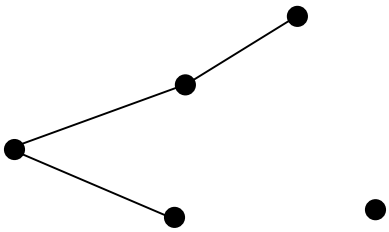


Module 5: Networks and decision mathematics

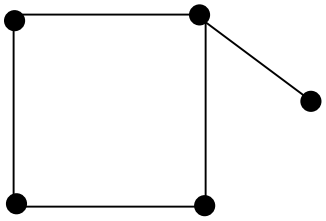
Question 5

Which one of the following is a tree?

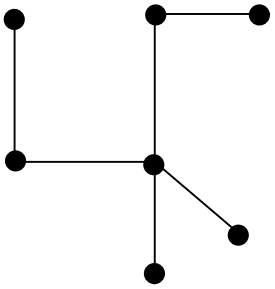
A.



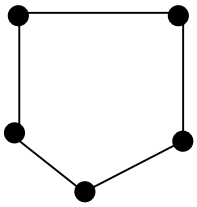
B.



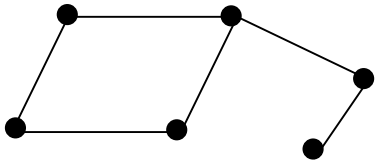
C.



D.



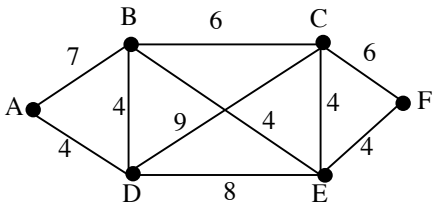
E.



Module 5: Networks and decision mathematics

Question 6

Anne lives in a country town and needs to travel to a large shopping centre. The following graph shows the different paths and distances from Anne's home at A to the shopping centre at F. The distances are in kilometres.



The shortest distance from Anne's home to the shopping centre is

A. 14 km.

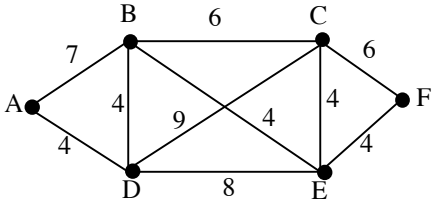
B. 15 km.

C. 16 km.

D. 18 km.

E. 19 km.

Question 7



What is the weight of the minimal spanning tree in the above diagram?

A. 14

B. 15

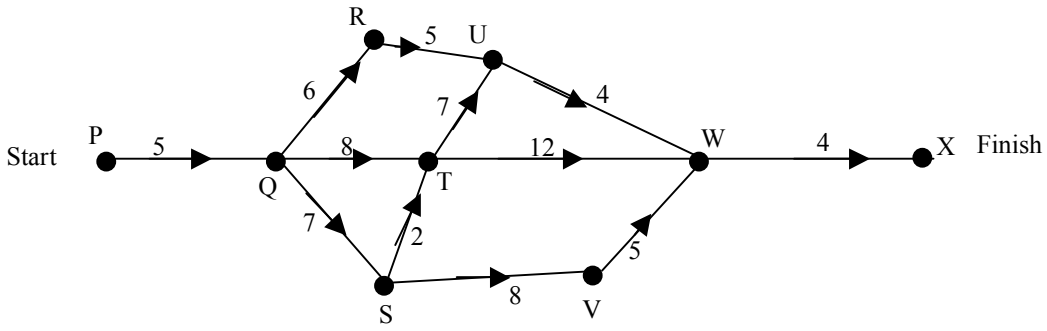
C. 20

D. 22

E. 24

Module 5: Networks and decision mathematics

The following information relates to Questions 8 and 9



The above network shows the length of time in hours for the completion of the various activities of a project.

Question 8

The critical path for the above network is

A. P Q R U W X

B. P Q T U W X

C. P Q T W X

D. P Q S T U W X

E. P Q S T W X

Question 9

The latest starting time for activity U, so as not to hold up the project is

A. 16 hours

B. 20 hours

C. 22 hours

D. 24 hours

E. 26 hours

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

Which one of the following would you use to begin solving these simultaneous equations?

$$\begin{aligned} 2x - y &= 5 \\ x - y + z &= 4 \\ x + 3z &= 7 \end{aligned}$$

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

B. $\begin{bmatrix} 2 & 1 & 1 \\ -1 & -1 & 1 \\ 1 & 3 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 7 \end{bmatrix}$

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

D. $\begin{bmatrix} 2 & -1 & 0 \\ 1 & -1 & 1 \\ 1 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 7 \end{bmatrix}$

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

Question 2

If $\begin{bmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ x & -3 \\ 4 & 0 \end{bmatrix} = \begin{bmatrix} 2 & -8 \\ 16 & 3 \end{bmatrix}$

then the value of x is

A. 0

B. 1

C. 2

D. -1

E. -2

Module 6: Matrices

Question 3

If $P = \begin{bmatrix} 5 & -1 & 2 \\ -1 & 5 & 2 \\ 2 & 2 & 2 \end{bmatrix}$ then P^2 equals

A. $6P$

B. P^{-1}

C. I

D. $6I$

E. $6P^{-1}$

Question 4

If P and Q are 3×2 matrices and R and T are 1×3 matrices, then which ONE of the following is defined?

A. $P(Q+T)$

B. $P(R+T)$

C. $(T+R)Q$

D. PQ

E. RPQ

Module 6: Matrices

Question 5

If $A = \begin{bmatrix} 6 & 1 \\ 8 & 4 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $\det(A - kI) = 0$, then k could equal

A. 1

B. 4

C. 6

D. 8

E. 10

Question 6

	Bays		Lees	
	Light	**Dark**	**Light**	**Dark**
Soft Centre	440	520	230	390
Hard Centre	360	195	480	500

Two confectioners, Bays and Lees, make light and dark chocolates with soft or hard centres. The table above shows the number of each type of chocolate made by each of the confectioners on a particular day. The cost of a chocolate at both stores depends only on whether the chocolate is dark or light. If the cost of a light chocolate is \$1.50 at each store and the cost of a dark chocolate is \$1.00 at Bays and \$3.00 at Lees, then which one of the following would give the cost of soft centre and hard centre chocolates at Lees?

A.

$$\begin{bmatrix} 440 & 520 \\ 360 & 195 \end{bmatrix} \begin{bmatrix} 1.50 \\ 3.00 \end{bmatrix}$$

B.

$$\begin{bmatrix} 230 & 480 \\ 390 & 500 \end{bmatrix} \begin{bmatrix} 1.50 \\ 3.00 \end{bmatrix}$$

C.

$$\begin{bmatrix} 230 & 390 \\ 480 & 500 \end{bmatrix} \begin{bmatrix} 1.50 & 3.00 \end{bmatrix}$$

D.

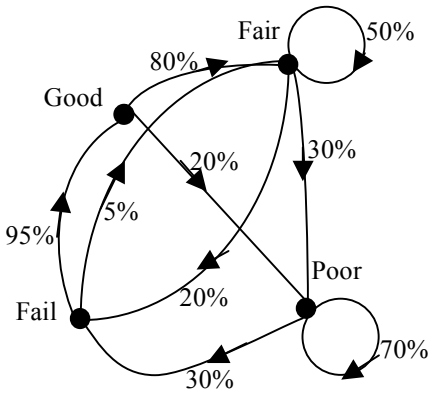
$$\begin{bmatrix} 230 & 480 \\ 390 & 500 \end{bmatrix} \begin{bmatrix} 1.50 & 3.00 \end{bmatrix}$$

E.

$$\begin{bmatrix} 230 & 390 \\ 480 & 500 \end{bmatrix} \begin{bmatrix} 1.50 \\ 3.00 \end{bmatrix}$$

Module 6: Matrices

The following information relates to Questions7 and 8



Question 7

A taxi company finds that car brakes when tested can be classified as good, fair, poor or fail. The above transition diagram can be used to predict the state of brakes at future inspections when the company only replaces brakes that have failed. Which one of the following matrices is equivalent to the transition diagram above?

A.

Next check up \ This check up	Good	Fair	Poor	Fail
Good	0.95	0.80	0.30	0
Fair	0.05	0	0	0.20
Poor	0	0	0.70	0.30
fail	0	0.20	0	0.95

B.

Next check up \ This check up	Good	Fair	Poor	Fail
Good	0	0.80	0.20	0
Fair	0	0.50	0.30	0.20
Poor	0	0	0.70	0.30
fail	0.95	0.50	0	0

C.

Next check up \ This check up	Good	Fair	Poor	Fail
Good	0	0.80	0.20	0
Fair	0	0.50	0.30	0.20
Poor	0	0	0.70	0.30
fail	0.95	0.05	0	0

D.

Next check up \ This check up	Good	Fair	Poor	Fail
Good	0	0	0	0.95
Fair	0.80	0.50	0	0.05
Poor	0.20	0.30	0.70	0
fail	0	0.20	0.30	0

E.

Next check up \ This check up	Good	Fair	Poor	Fail
Good	0	0	0	0.95
Fair	0.80	0.50	0	0.5
Poor	0.20	0.30	0.70	0
fail	0	0.20	0.30	0

Module 6: Matrices

Question 8

If 50 cars have fair brakes at one inspection, how many of these cars will you expect to have brakes that fail the next inspection?

A. 2

B. 3

C. 5

D. 8

E. 10

Question 9

If $X = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $Y = \begin{bmatrix} t & u \\ v & w \end{bmatrix}$
then for XY to equal YX, t must equal

A. $\frac{a}{b^2 - a^2}$

B. $\frac{b}{b^2 - a^2}$

C. $\frac{a}{a^2 - b^2}$

D. $\frac{b}{a^2 - b^2}$

E. a

End of Module 6

End of 2009 Further Mathematics Trial Examination 1
Multiple Choice Question Book

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