2010

VCE

Further Mathematics

Trial Examination 1

VICTORIAN CERTIFICATE OF EDUCATION 2010

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 48 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.

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VCE FURTHER MATHEMATICS 2010
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 2010
Trial Written Examination 1
ANSWER SHEET

NAME: _____

STUDENT NUMBER _____

SIGNATURE_____

Instructions

- Write your name in the space provided above.

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- **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

	A	B	C	D	E
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 2010
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						
Number patterns	**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 2						
Geometry and trigonometry	**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 3						
Graphs and relations	**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 turn over . . .

VCE FURTHER MATHEMATICS 2010
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	1	A	B	C	D	E
		2	A	B	C	D	E
	Business-related mathematics	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	1	A	B	C	D	E
		2	A	B	C	D	E
	Networks and decision mathematics	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	1	A	B	C	D	E
		2	A	B	C	D	E
	Matrices	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:
$$y = a + bx \text{ where } b = r\frac{s_y}{s_x} \text{ and } a = \bar{y} - b\bar{x}$$

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

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

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

Module 2: Geometry and trigonometry

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

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

circumference of a circle:
$$2\pi r$$

area of a circle:
$$\pi r^2$$

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:
$$\frac{1}{3} \text{ area of base} \times \text{height}$$

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

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

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

Module 3: Graphs and relations

Straight line graphs

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

equation: $\qquad$ $y = mx + c$

Module 4: Business-related mathematics

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

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

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

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

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

END OF FORMULA SHEET

Core

Question 1

The following are the test scores written down by a teacher for her class of ten students.

$$9, 9, 10, 11, 11, 11, 12, 15, 17, 19$$

If she made a mistake in entering the scores and the 19 should have been 16, which one of the following statistics will remain unchanged when she makes the correction?

A.   mean

B.   range

C.   interquartile range

D.   standard deviation

E.   variance

Core

Question 2

Site A			Site B			
7 4	3	7 9				
8 6 5 2	4	0 3 5 7				
8 7 3 0 0	5	0 2 4 6 8				
2 1 0	6	1 4 5				
8 0	7	3 8				

The developers record the noise level at two proposed residential sites, *A* and *B*.   The results are listed in the above back- to - back stem and leaf plot. Which one of the following statements is true?

A.   The median noise level at site *A* is 52.

B.   The median noise level at site *B* is 53.

C.   The interquartile range for the noise level at site *B* is 26.

D.   The lowest reading at both sites is 37.

E.   The highest reading at both sites is 87.

Core

Question 3
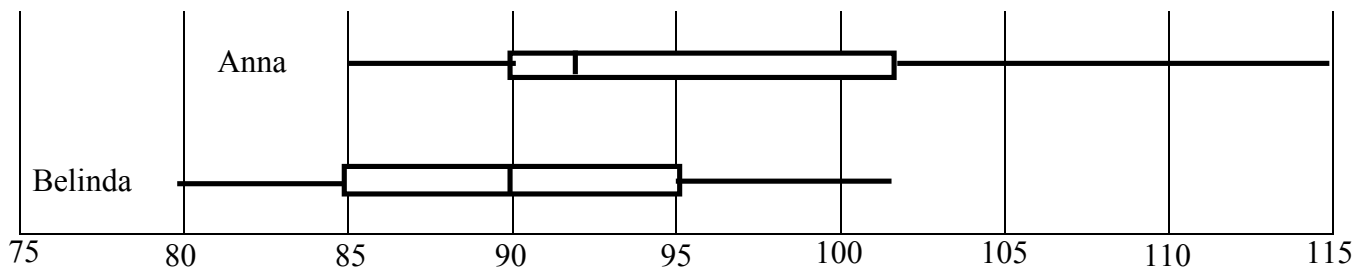
The above box plots show the golf scores for Anna and Belinda over the last month.
Which one of the following statements is true?

A.   75% of Anna's scores are less than Belinda's highest score.

B.   The interquartile range for Anna's scores is less than the interquartile range for Belinda's scores.

C.   50% of Anna's scores are greater than 102.

D.   Belinda's scores are positively skewed.

E.   Anna's scores are negatively skewed.

Core

Question 4

Voting Preference	Sex	
	Male	**Female**
Liberal	30	35
Labour	25	
Total	55	62

The above table shows the results of a survey where people were asked their voting preference at the next election. The percentage of people interviewed who said that they would vote for labour was closest to

A.   27%

B.   44%

C.   52%

D.   84%

E.   95%

Core

Question 5

Subject	Mark	Mean	Standard Deviation
English	80	70	10
Biology	85	70	15
Physics	95	67	15
Chemistry	75	55	10
Maths	80	60	12

The above table shows Jane's marks in the five subjects she studies and the class mean and standard deviation. Which subject was Jane's best, relative to the other students in her class?

A.   English

B.   Biology

C.   Physics

D.   Chemistry

**E.**   Maths

Question 6

The length of time that customers wait to be served at a fast food outlet is normally distributed with a mean of 25 seconds and a standard deviation of 3 seconds. The percentage of customers who wait more than 19 seconds is closest to

A.   0.15%

B.   2.5%

C.   53%

D.   97.5%

E.   99.7%

Core

Question 7

Ian has just completed research into the percentage of males and females who smoke, according to their employment classification. The best graph to display all of this information is

A.   A back-to-back stem plot

B.   A histogram

C.   A scatter plot

D.   Parallel box plots

E.   A segmented bar chart

Question 8
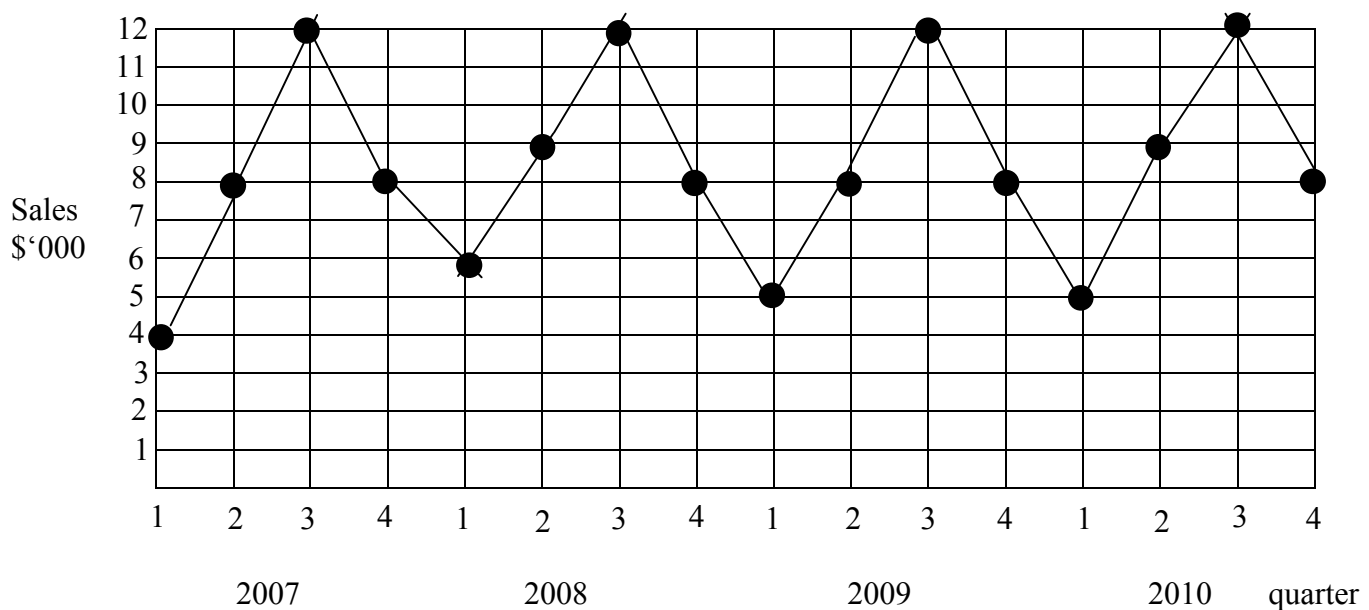
Which one of the following statements best describes the data shown in the above time series graph?

A.   The time series shows a linear trend only.

B.   The time series shows a seasonal pattern only.

C.   The time series shows a seasonal pattern and a linear trend.

D.   The time series shows a cyclical pattern only.

E.   The time series shows a cyclical pattern and a linear trend.

Core

The following information relates to Questions 9 to 11

The table below shows the relationship between age and systolic blood pressure for ten individuals.

Age (years)	Systolic Blood Pressure (mm/Hg)
25	108
34	126
31	120
25	110
48	138
60	164
75	165
52	120
46	118
73	150

Question 9

The least squares regression line for this data is closest to

A. $Age = 0.75 - 52 \times Systolic\ Blood\ Pressure$

B. $Age = 0.75 \times Systolic\ Blood\ Pressure + 52$

C. $Systolic\ Blood\ Pressure = 0.75 \times Age - 52$

D. $Systolic\ Blood\ Pressure = 1 + 85 \times Age$

E. $Systolic\ Blood\ Pressure = Age + 85$

Core

Question 10

The value of the coefficient of variation is closest to

A.   0.75

B.   0.84

C.   0.86
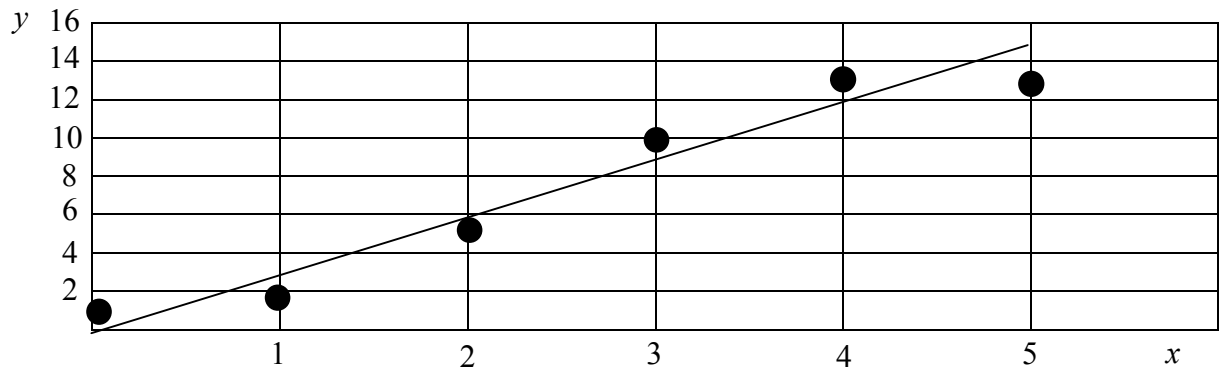
D.   0.87

E.   0.93

Question 11

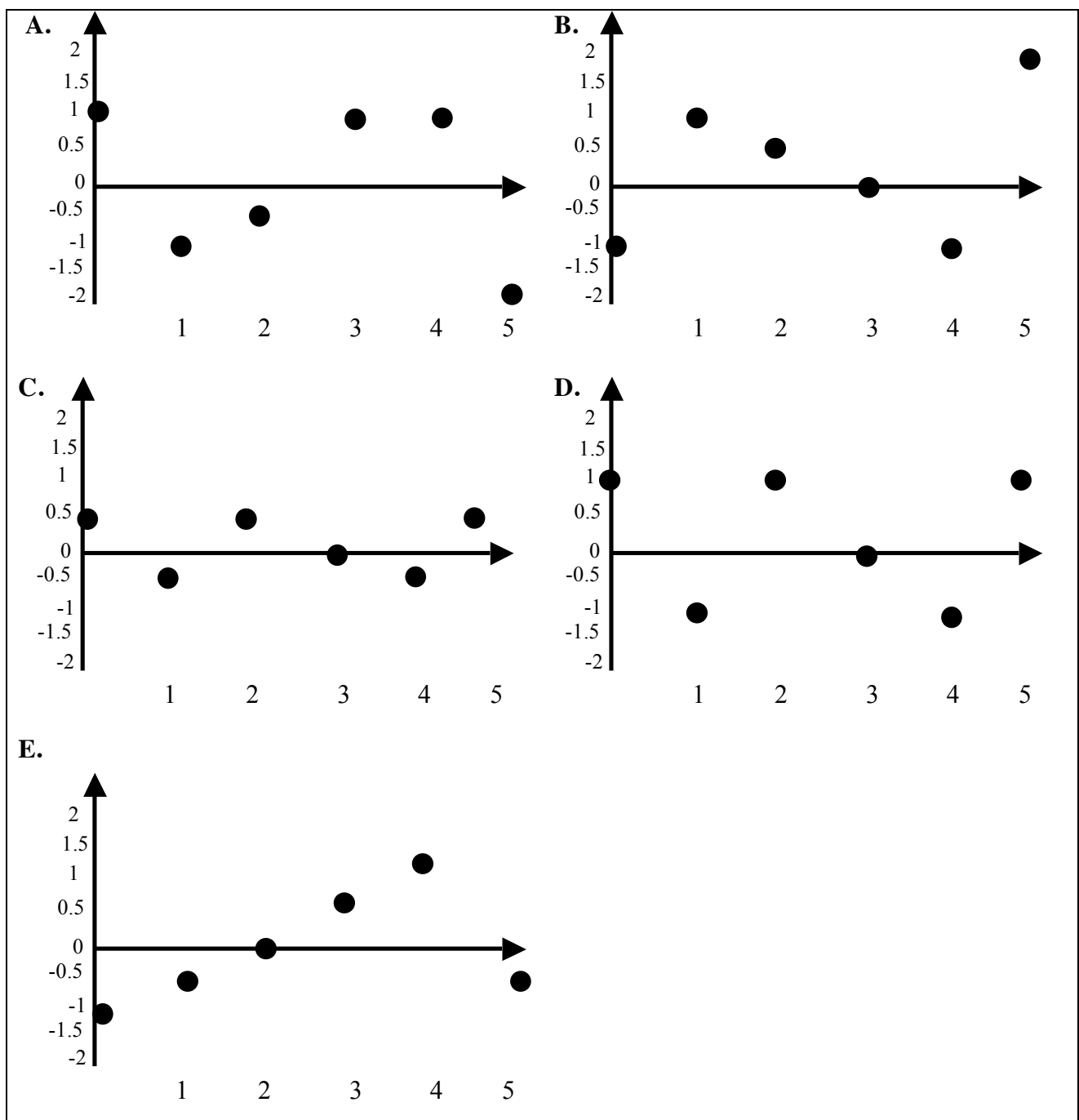The gradient of the three - median regression line is closest to

A.   0.8

B.   0.9

C.   1.1

D.   1.2

E.   1.4

Core

Question 12

Which one of the following could be the residual graph for the above least squares line?

A.

B.

C.

D.

E.

Core

Question 13

Three of the quarterly seasonal indices for sales of skis are shown in the table below.

Quarter	1	2	3	4
Seasonal Index	0.59	1.24		0.81

If the actual recorded value for the sale of skis in the third quarter is $32,465, then the deseasonalised value for this quarter is closest to

A. $18,865

B. $23,871

C. $28,569

D. $44,065

E. $46,065

END OF SECTION A

<div style="border: 1px solid black;">

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.

</div>

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

In the sequence, a, -2, -7, -12, -17……….., the value of a is

A.   4

B.   3

C.   0

D.   -1

E.   -22

Question 2

In an arithmetic sequence, if $t_2 = 9$ and $t_5 = 12$, then the sum of the first six terms equals

A.   99

B.   93

C.   69

D.   63

E.   24

Module 1: Number patterns and applications

Question 3

The number of terms in the sequence 2, 8, 32, 128, ………..32768 is

A.   6

B.   7

C.   8

D.   9

E.   10

Question 4

Two consecutive terms of a geometric sequence are $\dfrac{1}{2}$ and $\dfrac{1}{4}$.

If the sum to infinity of this sequence is 6, then the sum of the first four terms is

A. $5\dfrac{1}{8}$

B. $5\dfrac{1}{4}$

C. $5\dfrac{3}{8}$

D. $5\dfrac{5}{8}$

E. $5\dfrac{7}{8}$

Module 1: Number patterns and applications

Question 5

A certain sequence can be generated using the formula, $t_{n+1} - t_n = 3n,$ $t_1 = 4$
The first five terms of this sequence are

A.   4, 7, 13, 22, 34

B.   4, 10, 19, 31, 46

C.   4, 7, 10, 13, 16

D.   4, 12, 36, 108, 324

E.   4, 7, 11, 18, 29

Question 6

If $t_n = 2t_{n-1} + 3t_{n-2}$ $t_1 = t_2 = 1$, then the value of t_4 is

A.   49

B.   41

C.   19

D.   17

E.   13

Module 1: Number patterns and applications

Question 7
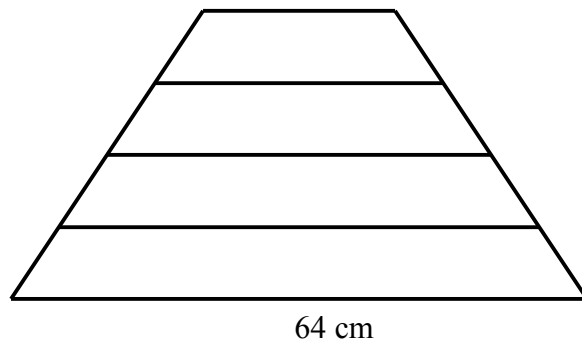
64 cm

The rungs of a ladder differ in length by 4 cm. The bottom rung is 64 cm long.
Which one of the following equations is true?

A. $t_{n+1} = t_n + 4$ $t_1 = 64$

B. $t_{n+1} + t_n = -4$ $t_1 = 64$

C. $t_{n+1} = t_n - 4$ $t_1 = 64$

D. $t_n = 60 - 4n$

E. $t_n = 60 + 4n$

Question 8

In a certain city, the population increases by 0.45% each year because of births, and by a fixed number of 5000 per year due to migration. In this city, 2400 people die each year. If the population was 20,000 at the beginning of 2010, which one of the following is closest to the population at the beginning of 2020?

A.   40,000

B.   45,000

C.   47,000

D.   50,000

E.   53,000

Module 1: Number patterns and applications

Question 9

A flea is a certain distance from a dog. The flea's first jump towards the dog is 10 cm, its second jump is 8 cm and its third jump is 6.4 cm. If the flea continues to jump towards the dog in this manner, what is the furthest distance that the flea could be from the dog originally and still manage to land on the dog?

A.   20 cm

B.   30 cm

C.   40 cm

D.   50 cm

E.   60 cm

End of Module 1

Module 2: Geometry and trigonometry

Before answering these questions you **must** shade the Geometry and trigonometry box on the answer sheet for multiple-choice questions
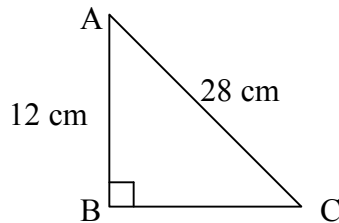
Question 1

In the right angled triangle, ABC, $AB = 12$ cm. and $AC = 28$ cm.
The magnitude of $\angle ACB$ is closest to

A. 23^0

B. 25^0

C. 65^0

D. 66^0

E. 67^0
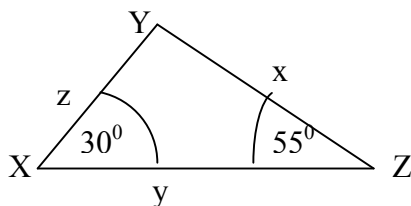
Question 2

For the above triangle where $\angle YXZ = 30^0$ and $\angle YZX = 55^0$, which one of the following is true?

A. $x = \dfrac{y\sin 30^0}{\sin 55^0}$

B. $x = \dfrac{y\sin 55^0}{\sin 30^0}$

C. $x = \dfrac{z\sin 55^0}{\sin 30^0}$.

D. $x = \dfrac{y\sin 95^0}{\sin 30^0}$

E. $x = \dfrac{y\sin 30^0}{\sin 95^0}$
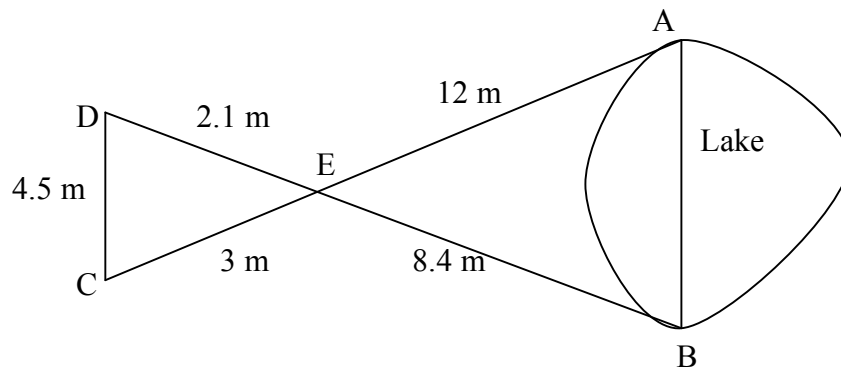
Module 2: Geometry and trigonometry

Question 3
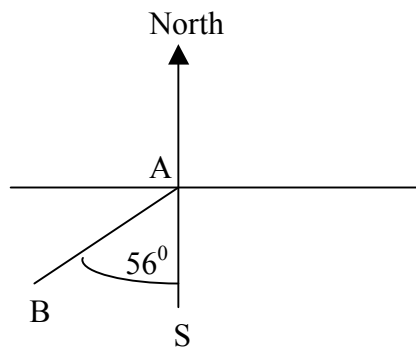
The bearing of B from A where $\angle BAS$ is 56^0 is

A. 056^0T

B. 124^0T

C. 146^0T

D. 236^0T

E. 304^0T
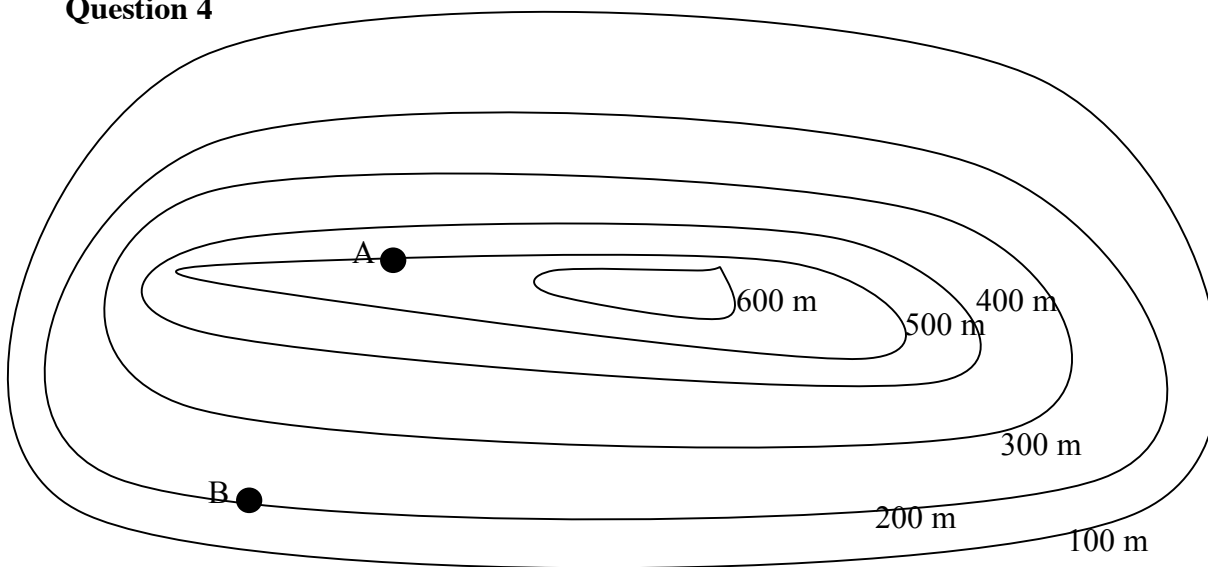
Question 4

If the distance from B to A is 600 metres, then the gradient from B to A is closest to

A. 0.01

B. 0.03

C. 0.5

D. 0.6

E. 1.7

Module 2: Geometry and trigonometry

Question 5

A surveyor wishes to measure the width of a lake at its widest part, *AB*. She puts stakes in the ground at *A* and *B* and then more stakes at *C*, *D* and *E*, where *E* is the point where *AC* and *BD* cross. By measuring, she finds $AE = 12$ m, $DE = 2.1$ m, $CE = 3$ m, $EB = 8.4$ m and $CD = 4.5$ m. What is the length of *AB*?

A.   6.3 m

B.   9 m

C.   12.6 m

D.   18 m

E.   25.7 cm

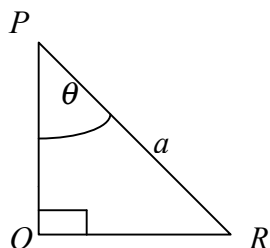**Module 2: Geometry and trigonometry**

Question 6
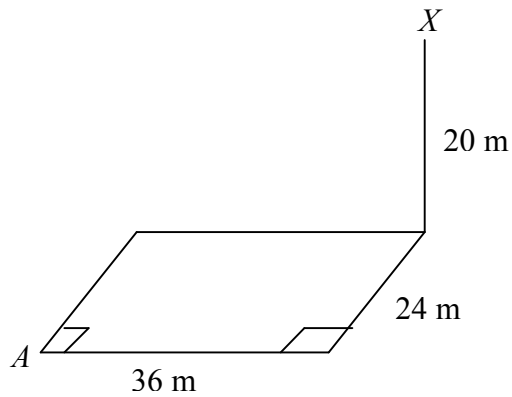
A vertical pole, 20 m high, is at one corner of a rectangular field, 36 m by 24 m. A bird on the pole at X watches a worm at A. The angle of depression from the bird to the worm is closest to

A 25^0

B. 27^0

C. 29^0

D. 40^0

E. 65^0

Module 2: Geometry and trigonometry

Question 7

A cubical box with side l cm contains a spherical ball that just fits inside the box and touches each side of the box. The percentage of the space inside the box **not** occupied by the ball is closest to

A.   21%

B.   26%

C. $34l^3$%

D.   48%

E.   53%

Question 8

The area of the above right angled triangle, PQR, with $PR = a$ and $\angle QPR = \theta$ can be given by

A. $\dfrac{1}{2}a^2 \sin\theta \cos\theta$

B. $\dfrac{1}{2}a^2 \sin\theta$

C. $\dfrac{1}{2}a^2 \cos\theta$

D. $\sqrt{s(s-a)(s-p)(s-q)}$

E. $\dfrac{1}{4}a^2\sqrt{3}$

Module 2: Geometry and trigonometry

Question 9
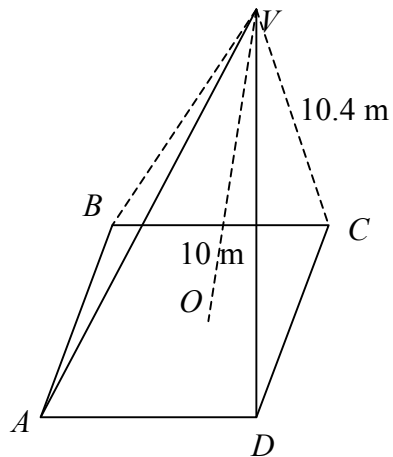
The above right rectangular pyramid has a slant height, *VC*, of 10.4 m, and a height, *VO* of 10 m. The length, *AB*, is twice the width, *AD*. The length of *AB* is closest to

A.   2.6 m

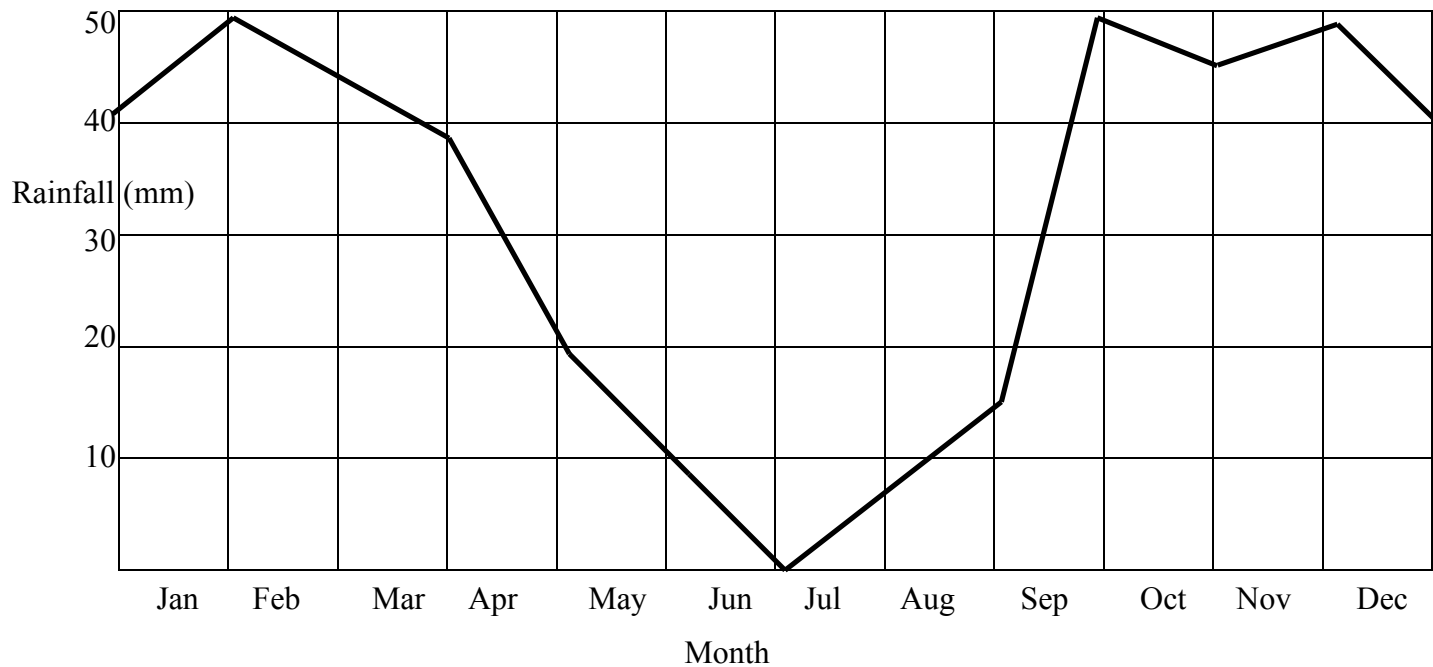**B.**   3.3 m

C.   5.1 m

D.   5.7m

E.   6.6 m

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

The following information refers to questions 1 and 2

The above graph shows the rainfall in *Showerville* over a period of a year.

Question 1

Between which two consecutive months is there the greatest decrease in rainfall?

A.   April to May

B.   May to June

C.   June to July

D.   August to September

E.   September to October

Module 3: Graphs and relations

Question 2

For approximately how many months is the rainfall **at least** 20 mm?

A.   3

B.   4

C.   6

D.   8

E.   9

Question 3
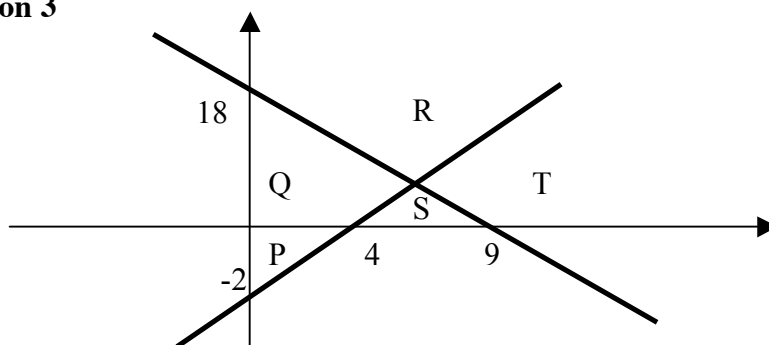
The above graph shows the lines $x - 2y = 4$ and $2x + y = 18$

Which one of the above areas would represent the region $x - 2y \leq 4$ and $2x + y \geq 18$?

A.   P

B.   Q

C.   R

D.   S

E.   T

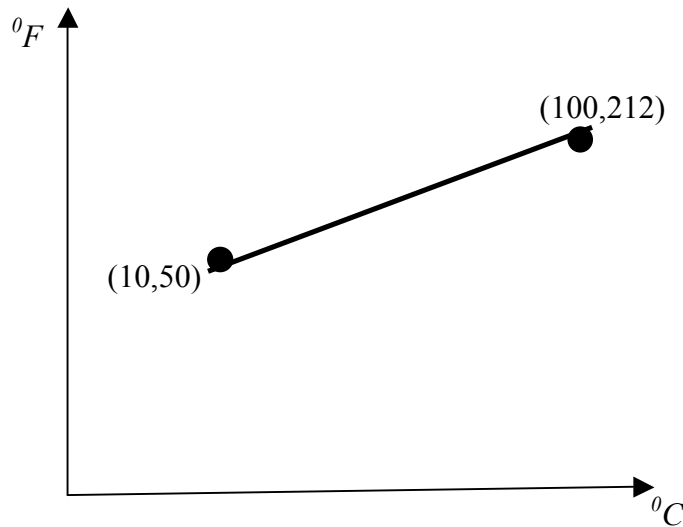**Module 3: Graphs and relations**

Question 4

On a certain road, the toll is $12 for the car and driver and $$x$ for each additional person.
The toll for p people in a car is

A. $$(xp + 12)$

B. $$(xp - x + 12)$

C. $$(xp - p + 12)$

D. $$(x + p + 11)$

E. $$(x - p + 13)$

Module 3: Graphs and relations

The following information refers to questions 5 and 6.

The above graph shows the relationship between degrees Celsius, which is used to measure temperature in Australia and degrees Fahrenheit, which is used to measure temperature in America.

Question 5

What is the gradient of the line?

A.   0.36

B.   0.56

C.   1.8

D.   2.4

E.   2.8

Question 6

Which one of the following would be the closest Fahrenheit temperature to 30^0 Celsius?

A. 34^0

B. 78^0

C. 86^0

D. 92^0

E. 112^0

Module 3: Graphs and relations

Question 7

Greta has a part-time job which pays a basic hourly wage for hours worked before 11.00 pm and a different hourly rate for hours worked after 11.00 pm. In a week when she worked 25 hours where 6 of those hours were after 11.00 pm, she received $784. Another week when she worked 21 hours where 8 of those hours were after 11.00 pm she earned $700. How much does she earn per hour for working after 11.00 pm?
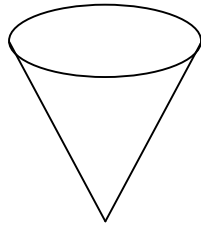
A. $14

B. $28

C. $35

D. $42

E. $49
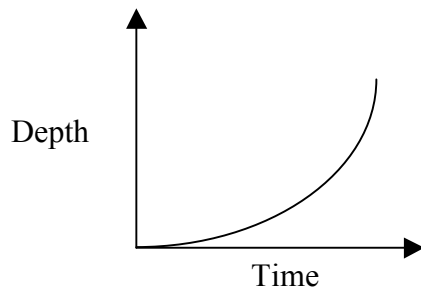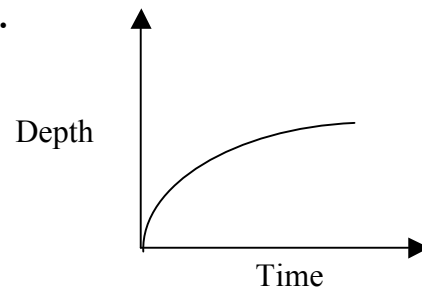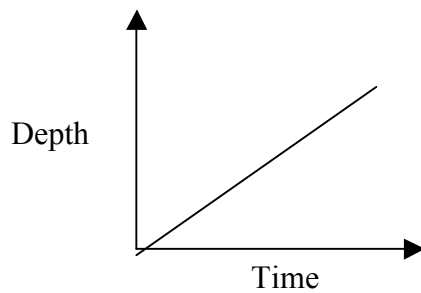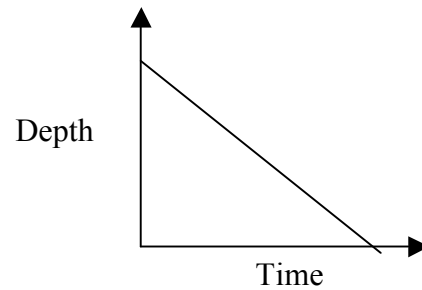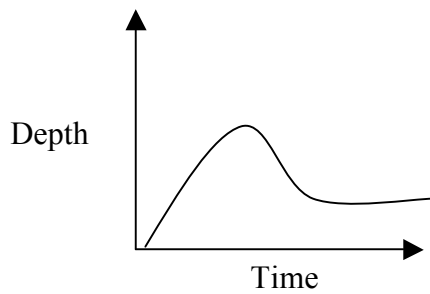

Question 8
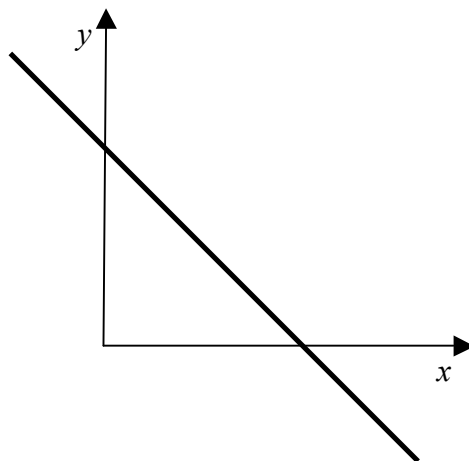
The above line has the equation $px + y + r = 0$

Which one of the following statements must be true?

A. p is positive and r is positive.

B. p is negative and r is negative.

C. p is negative and r is positive.

D. p is positive and r is negative.

E. p could be positive or negative but r must be positive.

Module 3: Graphs and relations

Question 9

Which one of the following graphs best matches the rate at which the above vase fills with water?

A.

B.

C.

D.

E.

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

An amount of $45,000 is invested for 6 years. What simple interest rate per annum will give a total interest of $25,110?

A.   3.4%

B.   7.5%

C.   9.3%

D.   30%

E.   33.5%

Question 2

Carpet is purchased for $7,500. It is expected that it will last for 10 years and then have a residual value of $1,400. Assuming a flat rate depreciation, how much depreciation should be allowed each year?

A. $305

B. $610

C. $650

D. $890

E. $1220

Module 4: Business-related mathematics

Question 3

Steve bought a second hand car that had a cash price of $6600. He did not have the cash so he bought it on hire purchase. He paid a $1,000 deposit and then paid $180 per month for three years. How much interest did he pay?
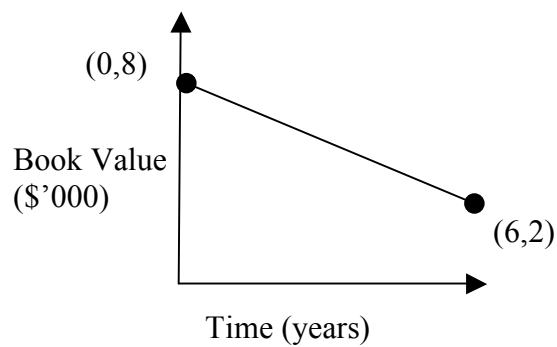
A. $240

B. $480

C. $540

D. $560

E. $880

Question 4

Clare bought a sound system for $3,500. If the sound system depreciates by 7% each year, its value at the end of 9 years will be closest to

A. $1412

B. $1694

C. $1821

D. $1959

E. $2018

Module 4: Business-related mathematics

Question 5

The above graph represents the depreciation of office equipment, from the time it was purchased until it is written off. Which one of the following statements is true?

A.   The rate of depreciation is $1,000 per year.

B.   The rate of depreciation is $2,000 per year.

C.   The scrap value is $8,000

D.   The scrap value is $6,000

E.   The office equipment was written off after 2 years.

Module 4: Business-related mathematics

Question 6

Taxable Income	Tax on Income	Tax Rate
$0 - $6,000	Nil	0%
$6,001 - $35,000	15 cents for each dollar over $6,000	15%
$35,001 - $80,000	$4,350 +30 cents for each dollar over $35,000	30%
$80,001 - $180,000	$17,850 +38 cents for each dollar over $80,000	38%
Over $180,000	$55,850 +45 cents for each dollar over $180,000	45%

Martha's gross salary is $78,000 per annum. If she gets a raise of $7,000 per annum, use the above tax scale to find which one of the following is closest to the extra tax she will have to pay.

A. $400

B. $600

C. $1,900

D. $2,500

E. $13,500

Module 4: Business-related mathematics

Question 7

Josie invested $16,000 for 5 years at an interest rate of 8% per annum compounded quarterly. The amount of interest that Josie earns in that time is

A. $1,665

B. $1,678

C. $2,274

D. $6,400

E. $7,775

Question 8

Helen and Greg borrow $82,000 to renovate their home. They agree to make monthly repayments of $2,100 with interest charged at 6% per annum on the unpaid balance. The number of years it will take to repay the loan is closest to

A.   3

B.   4

C.   15

D.   16

E.   24

**Module 4: Business-related mathematics**

Question 9

Li borrowed $36,000. He agreed to repay quarterly instalments of $880 with the interest of 7.5% per annum on the unpaid money debited quarterly. After 5 years he increased the repayments to $1,400 a quarter. The total length of time it will take to repay the loan is closest to

A.   7 years.

B.   12 years.

C.   19 years.

D.   21 years.

E.   28 years.

End of Module 4

Module 5: Networks and decision mathematics

Before answering these questions you **must** shade the Networks and decision mathematics box on the answer sheet for multiple-choice questions.
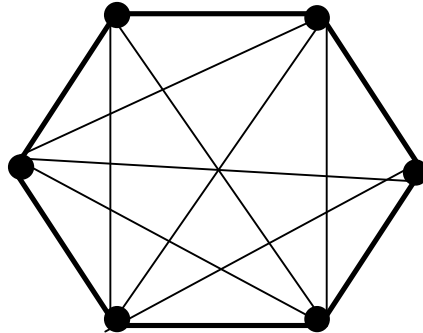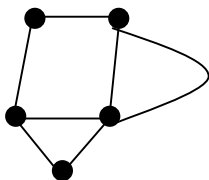
Question 1

The number of edges in this complete graph is

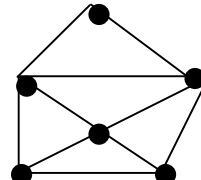**A.**   10

B.   12

C.   13

D.   15

F.   16

Question 2
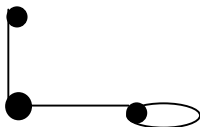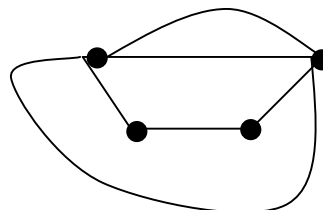
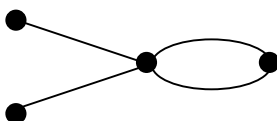Which one of the following is a simple graph?

A.

B.

C.

D.

E.

Module 5: Networks and decision mathematics

Question 3

Which one of the following has an Euler path?

A.
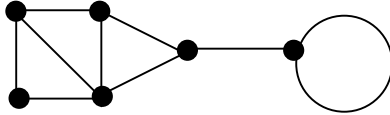
B.
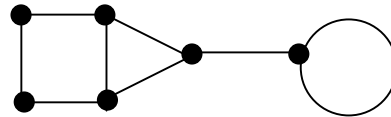
C.
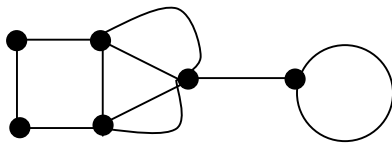
D.
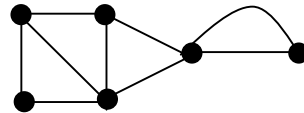
E.
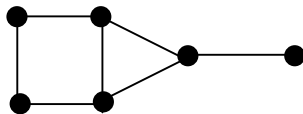
Question 4

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

A.   The number of edges of a tree is one more than the number of vertices.

B.   A tree is a connected graph.

C.   A tree has only one face.

D.   The difference between the number of vertices and the number of edges of a tree is 1.

E.   A tree has no multiple edges.

Module 5: Networks and decision mathematics

Question 5

The matrix below shows the roads between six towns, A, B, C, D, E and F and the distances in kilometres between the towns. An X means that there is no road connecting those two towns directly.

$$
\begin{array}{c c}
 & \begin{matrix} A & B & C & D & E & F \end{matrix} \\
\begin{matrix} A \\ B \\ C \\ D \\ E \\ F \end{matrix} &
\left[\begin{matrix}
0 & 5 & 2 & X & X & X \\
5 & 0 & 3 & X & 4 & X \\
2 & 3 & 0 & 7 & 4 & X \\
X & X & 7 & 0 & 2 & 1 \\
X & 4 & 4 & 2 & 0 & 4 \\
X & X & X & 1 & 4 & 0
\end{matrix} \right]
\end{array}
$$

What is the length of the shortest route between A and F?

A.   8 km

B.   9 km

C.   10 km

D.   13 km

E.   15 km

Module 5: Networks and decision mathematics

Question 6

Euler's formula does NOT apply to which one of the following?

A.
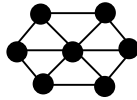
B.
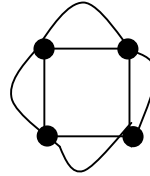
C.
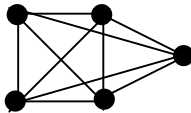
D.
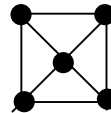
E.
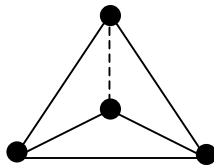
Question 7
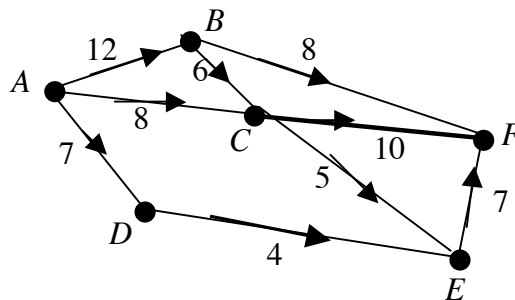
The above graph shows the number of available seats on planes to six country towns.
The maximum number of people who can travel from *A* to *F* is

A.   18

B.   23

C.   24

D.   26

E.   27

Module 5: Networks and decision mathematics

Question 8

Four people, Andy, Ben, Cathy and Demi are to be allocated to four different sports, Tennis, Netball, Squash and Darts, based on their average scores in each of these sports over the past month. Their average scores are listed in the table below.

	Tennis	**Netball**	**Squash**	**Darts**
Andy	6	10	10	7
Ben	7	4	4	8
Cathy	9	9	10	8
Demi	14	8	9	20

It is required to maximize these average scores in order to select the best person for each sport, with each person playing one sport only. Which one of the following gives the correct selection for Tennis and Squash?

A.   Ben plays Tennis and Andy plays Squash.

B.   Cathy plays Tennis and Demi plays Squash.

C.   Cathy plays Tennis and Andy plays Squash.

D.   Andy plays Tennis and Cathy plays Squash.

E.   Ben plays Tennis and Cathy plays Squash.

Module 5: Networks and decision mathematics

Question 9

G, 6
D, 7   F,5
A, 6
H, 4
K,2
L, 1
C, 4
B, 10   E, 4
J, 4
I, 3
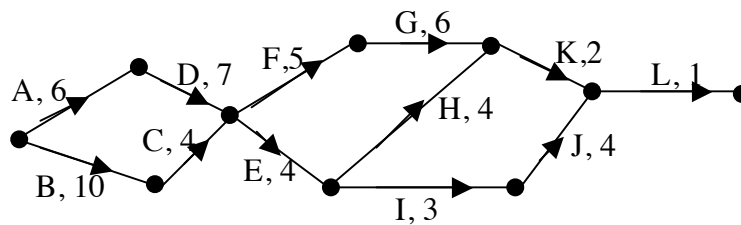
The above network shows the activities required to complete a project, and the time each activity will take in days. If the project is crashed, by reducing the completion time of F by 4 days, then the completion time of the whole project will be reduced by

A.   1 day.

B.   2 days.

C.   3 days.

D.   4 days.

E.   5 days.

End of Module 5

Module 6: Matrices

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

Question 1

If $k = -3$ and $A = \begin{bmatrix} -1 & 2 \\ 6 & -4 \\ 0 & 3 \end{bmatrix}$,

then kA equals

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

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

C. $\begin{bmatrix} 3 & -6 \\ -18 & 12 \\ 0 & 9 \end{bmatrix}$

D. $\begin{bmatrix} 3 & -6 \\ -18 & 12 \\ -3 & -9 \end{bmatrix}$

E. $\begin{bmatrix} 3 & -6 \\ -18 & 12 \\ 0 & -9 \end{bmatrix}$

Module 6: Matrices

Question 2

If $P = \begin{bmatrix} 2 & -1 & 4 \\ -3 & 3 & 6 \end{bmatrix}$, $Q = \begin{bmatrix} 2 & 0 & -3 \\ 1 & 8 & 7 \end{bmatrix}$ and $P + Q + R = \begin{bmatrix} 8 & -1 & 2 \\ 0 & 16 & 20 \end{bmatrix}$ then R equals

A. $\begin{bmatrix} 0 & -2 & 0 \\ -6 & 0 & 7 \end{bmatrix}$

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

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

D. $\begin{bmatrix} 12 & 0 & 3 \\ -4 & 27 & 33 \end{bmatrix}$

E. $\begin{bmatrix} 12 & -2 & 3 \\ -2 & 27 & 33 \end{bmatrix}$

Question 3

If $A = \begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$, then the value of s is

A. 0.4

B. −0.4

C. −4

D. 4

E. $\dfrac{2}{7}$

Module 6: Matrices

Question 4

If $A = \begin{bmatrix} 6.3 & -2.3 \\ 0.5 & -4.4 \end{bmatrix}$, then $5I - A$ equals

A. $\begin{bmatrix} -1.3 & 7.3 \\ 4.5 & 9.4 \end{bmatrix}$

B. $\begin{bmatrix} -1.3 & 2.7 \\ 4.5 & 4.4 \end{bmatrix}$

C. $\begin{bmatrix} -1.3 & 2.3 \\ -0.5 & 9.4 \end{bmatrix}$

D. $\begin{bmatrix} -6.3 & 7.3 \\ 4.5 & 4.4 \end{bmatrix}$

E. $\begin{bmatrix} -6.3 & 2.7 \\ 4.5 & -4.4 \end{bmatrix}$

Module 6: Matrices

Question 5

$$3a + 2b = 6$$
$$4b + 7c = 8$$
$$5c + 2d = 9$$
$$a + d = 5$$

Which one of the following matrix equations could be used to solve the above system of simultaneous equations?

A. $\begin{bmatrix} 3 & 2 \\ 4 & 7 \\ 5 & 2 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} 6 \\ 8 \\ 9 \\ 5 \end{bmatrix}$

B. $\begin{bmatrix} 3 & 2 & 0 & 0 \\ 4 & 7 & 0 & 0 \\ 5 & 2 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} 6 \\ 8 \\ 9 \\ 5 \end{bmatrix}$

C. $\begin{bmatrix} 3 & 2 & 0 & 0 \\ 0 & 4 & 7 & 0 \\ 0 & 0 & 5 & 2 \\ 1 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a & b & c & d \end{bmatrix} = \begin{bmatrix} 6 \\ 8 \\ 9 \\ 5 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 4 & 7 & 0 \\ 3 & 2 & 0 & 0 \\ 0 & 0 & 5 & 2 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} 5 \\ 8 \\ 6 \\ 9 \end{bmatrix}$

E. $\begin{bmatrix} 1 & 0 & 0 & 1 \\ 3 & 2 & 0 & 0 \\ 0 & 4 & 7 & 0 \\ 0 & 0 & 5 & 2 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} 6 \\ 8 \\ 9 \\ 5 \end{bmatrix}$

Module 6: Matrices

Question 6

If $\begin{bmatrix} a & 2a \\ b & a \end{bmatrix}$ is a singular matrix, then

A. $a = \dfrac{b}{2}$ or 0

B. $a = 2b$ or 0

C. $a = b + 2$

D. $a = -\dfrac{b}{2}$ or 0

E. $a = 0$ only

Module 6: Matrices

Question 7

A bookshop specializes in Murder Mysteries, Romantic Novels and Autobiographies. Each murder mystery sold gives a profit of $2.40, each romantic novel sold gives a profit of $1.80 and each autobiography sold gives a profit of $4.90. In the first week of October, the number of each type of book sold was 150, 260 and 80 respectively, and in the second week of October, the number of books sold was 212, 245 and 64 respectively. Which one of the following would give the bookshop's profit for each of the two weeks?

A.
$$\begin{bmatrix} 150 & 212 \\ 260 & 245 \\ 80 & 64 \end{bmatrix} \begin{bmatrix} 2.40 \\ 1.80 \\ 4.90 \end{bmatrix}$$

B.
$$\begin{bmatrix} 2.40 \\ 1.80 \\ 4.90 \end{bmatrix} \begin{bmatrix} 150 & 212 \\ 260 & 245 \\ 80 & 64 \end{bmatrix}$$

C.
$$\begin{bmatrix} 150 & 260 & 80 \\ 212 & 245 & 64 \end{bmatrix} \begin{bmatrix} 2.40 & 1.80 & 4.90 \end{bmatrix}$$

D.
$$\begin{bmatrix} 150 & 260 & 80 \\ 212 & 245 & 64 \end{bmatrix} \begin{bmatrix} 2.40 \\ 1.80 \\ 4.90 \end{bmatrix}$$

E.
$$\begin{bmatrix} 2.40 \\ 1.80 \\ 4.90 \end{bmatrix} \begin{bmatrix} 150 & 260 & 80 \\ 212 & 245 & 64 \end{bmatrix}$$

Module 6: Matrices

Question 8

A surfboard manufacturer sells long boards and short boards. She finds that for those who buy a new board each year, 60% of those who buy a long board one year, will buy a short board the next year, and 30% of those who buy a short board one year will buy a long board the next year. The transition matrix that can be used for this situation is

A.

$$
\begin{array}{c}
\textit{This year} \\
\begin{array}{cc} LB & SB \end{array} \\
\textit{Next year} \quad
\begin{array}{c} LB \\ SB \end{array}
\begin{bmatrix} 0.4 & 0.6 \\ 0.3 & 0.7 \end{bmatrix}
\end{array}
$$

B.

$$
\begin{array}{c}
\textit{This year} \\
\begin{array}{cc} LB & SB \end{array} \\
\textit{Next year} \quad
\begin{array}{c} LB \\ SB \end{array}
\begin{bmatrix} 0.6 & 0.3 \\ 0.4 & 0.7 \end{bmatrix}
\end{array}
$$

C.

$$
\begin{array}{c}
\textit{This year} \\
\begin{array}{cc} LB & SB \end{array} \\
\textit{Next year} \quad
\begin{array}{c} LB \\ SB \end{array}
\begin{bmatrix} 0.6 & 0.7 \\ 0.4 & 0.3 \end{bmatrix}
\end{array}
$$

D.

$$
\begin{array}{c}
\textit{This year} \\
\begin{array}{cc} LB & SB \end{array} \\
\textit{Next year} \quad
\begin{array}{c} LB \\ SB \end{array}
\begin{bmatrix} 0.6 & 0.4 \\ 0.7 & 0.3 \end{bmatrix}
\end{array}
$$

E.

$$
\begin{array}{c}
\textit{This year} \\
\begin{array}{cc} LB & SB \end{array} \\
\textit{Next year} \quad
\begin{array}{c} LB \\ SB \end{array}
\begin{bmatrix} 0.4 & 0.3 \\ 0.6 & 0.7 \end{bmatrix}
\end{array}
$$

Module 6: Matrices

Question 9

If $A = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ and $2A^3 = I,$ then A^{-1} equals

A. $\begin{bmatrix} 8p^2 + 8qr & 8pq + 8qs \\ 8pr + 8rs & 8qr + 8s^2 \end{bmatrix}$

B. $\begin{bmatrix} 2p^2 + 2qr & 2pq + 2qs \\ 2pr + 2rs & 2qr + 2s^2 \end{bmatrix}$

C. $\begin{bmatrix} \dfrac{1}{8}p^2 & \dfrac{1}{8}q^2 \\ \dfrac{1}{8}r^2 & \dfrac{1}{8}s^2 \end{bmatrix}$

D. $\begin{bmatrix} 8p^2 & 8q^2 \\ 8r^2 & 8s^2 \end{bmatrix}$

E. $\begin{bmatrix} 2p^2 & 2q^2 \\ 2r^2 & 2s^2 \end{bmatrix}$

End of Module 6

End of 2010 Further Mathematics Trial Examination 1
Multiple Choice Question Book