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YEAR 12 *Trial Exam Paper*

2019

FURTHER MATHEMATICS

Written examination 1

STUDENT NAME:

Reading time: 15 minutes
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 – Core	24	24			24
B – Modules	32	16	4	2	16
					Total 40

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared. For approved computer-based CAS, full functionality may be used.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

- Question book of 39 pages
- Formula sheet
- Answer sheet for multiple-choice questions
- Working space is provided throughout the book.

Instructions

- Write your **name** in the space provided above and on the multiple-choice answer sheet.
- 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 and the formula sheet.

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

SECTION A – CORE

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.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Data analysis

Use the following information to answer Questions 1 and 2.

The stem plot below displays the *weight,* in kilograms, of the first 25 babies born at a local hospital in 2019.

birth weight key: 0 | 1 = 0.1

0	
1	7 9
2	2 4 6 7 8
3	1 2 3 3 4 5 5 6 6 7 9
4	2 3 3 5 7 8
5	1

Question 1

The percentage of babies born with a *weight* between 2.0 and 4.0 kilograms is

A. 4%

B. 8%

C. 36%

D. 64%

E. 66%

Question 2

The median *weight* of the newborn babies, in kilograms, is

A. 3.3

B. 3.4

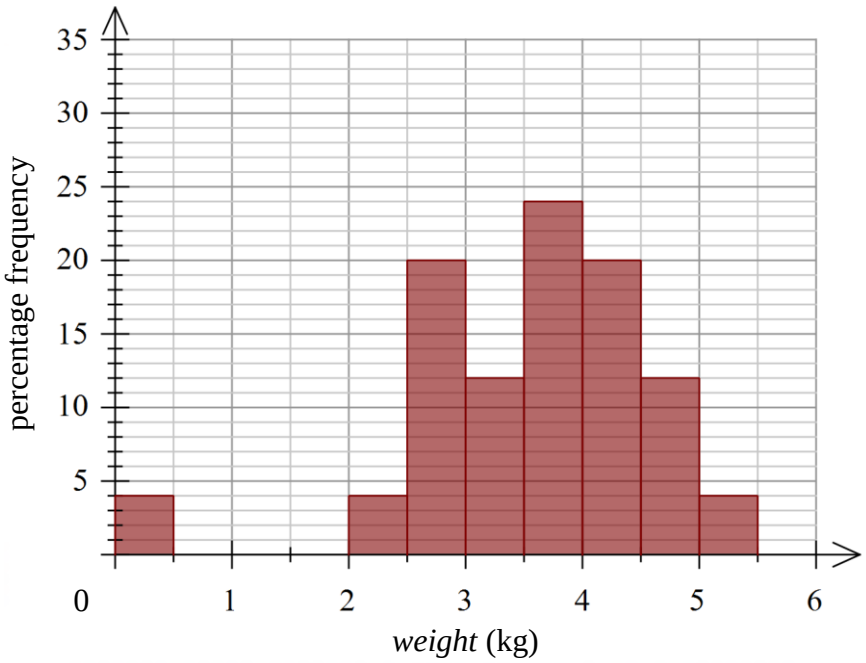
C. 3.5

D. 3.6

E. 5.0

Question 3

The percentage frequency histogram below displays the *weight*, in kilograms, of the next 25 babies born at the local hospital in 2019.



The percentage of babies born who are above the state average of 3.5 kilograms at birth is

A. 38%

B. 40%

C. 50%

D. 60%

E. 62%

Use the following information to answer Questions 4–6.

The birth weight of Victorian babies, born at 39 weeks or later, according to 2018 statistics, is approximately normally distributed with a mean of 3.3 kilograms and a standard deviation of 300 grams.

Question 4

A baby selected at random from the sample used has a standardised birth weight of $z = 0.8$.

The baby's actual birth weight, in kilograms, is

A. 0.75

B. 2.64

C. 3.06

D. 3.50

E. 3.54

Question 5

What percentage of babies born in Victoria can be expected to weigh between 2.7 and 3.9 kilograms at birth?

A. 64.0%

B. 66.5%

C. 81.5%

D. 95.0%

E. 99.7%

Question 6

A sample of 150 babies was chosen for closer studies.

The predicted number of these babies with a birth weight less than 3.0 kilograms or greater than 3.9 kilograms is closest to

A. 16

B. 17

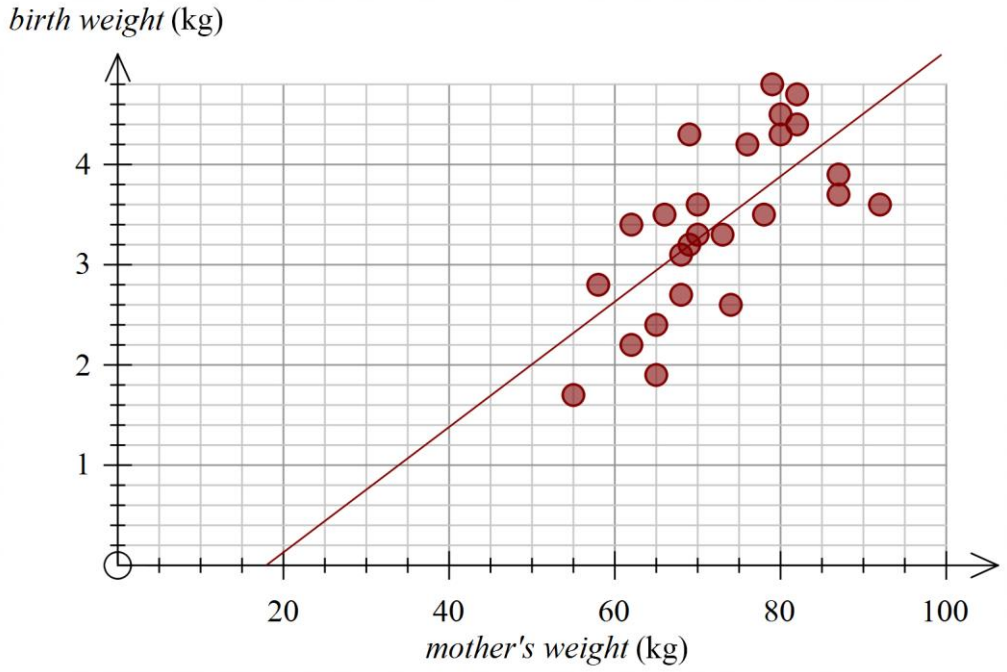
C. 26

D. 27

E. 28

Use the following information to answer Questions 7–10.

The scatterplot below displays the *birth weight*, in kilograms, of newborn babies, and weight, in kilograms, of the mother at 39 weeks pregnant. A least squares line has been fitted to the data.



Question 7

Using the least squares line, the predicted value for *birth weight*, when *mother's weight* is 60 kilograms, is approximately

A. 2.6

B. 3.2

C. 3.4

D. 3.6

E. 4.0

Question 8

The equation of the least squares line is closest to

A. $\textit{mother's weight} = -1.1203 + 0.063 \times \textit{birth weight}$

B. $\textit{mother's weight} = 1.1203 - 0.063 \times \textit{birth weight}$

C. $\textit{birth weight} = -1.1203 - 0.063 \times \textit{mother's weight}$

D. $\textit{birth weight} = 1.1203 + 0.063 \times \textit{mother's weight}$

E. $\textit{birth weight} = -1.1203 + 0.063 \times \textit{mother's weight}$

Question 9

If the coefficient of determination is 0.6877, the correlation coefficient, *r*, is closest to

A. –0.829

B. –0.688

C. –0.473

D. 0.473

E. 0.829

Question 10

Using this least squares line to model the association between *mother's weight* and *birth weight*, the residual value for a baby that is born to a mother weighing 92 kilograms is closest to

A. –2.0 kg

B. –1.0 kg

C. –0.30 kg

D. 0.30 kg

E. 2.0 kg

Question 11

The statistical analysis of a set of bivariate data involving variables *x* and *y* resulted in the information displayed in the table below.

Mean	$\bar{x} = 8$	$\bar{y} = 50.53$
Standard deviation	$s_x = 4.47$	$s_y = 18.77$
Correlation coefficient	$r = 0.98$	

Using this information, the equation of the least squares line in the form $y = a + bx$ is

A. $y = -200.18 + 4.1x$

B. $y = 48.66 + 0.23x$

C. $y = 17.6 - 4.1x$

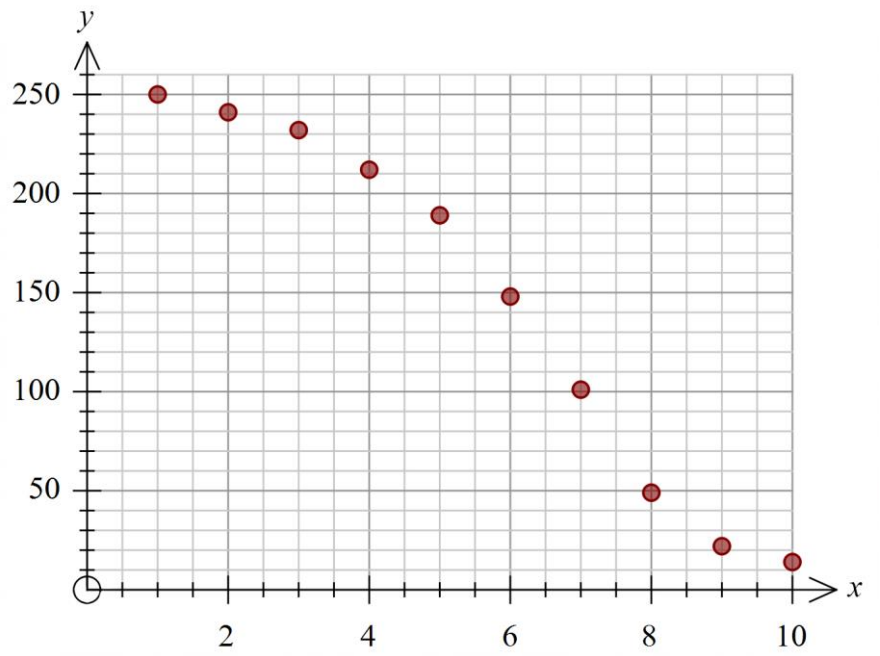
D. $y = 4.1 + 17.6x$

E. $y = 17.6 + 4.1x$

Use the following information to answer Questions 12 and 13.

Jaxon uses the following data to generate the scatterplot below.

x	1	2	3	4	5	6	7	8	9	10
y	250	241	232	212	189	148	101	49	22	14



The scatterplot shows that the data is non-linear.

Question 12

To linearise the data, Jaxon could apply which of the following sets of transformations?

A. x^2 or $\frac{1}{y}$

B. x^2 or y^2

C. x^2 or $\log y$

D. y^2 or $\log x$

E. y^2 or $\frac{1}{x}$

Question 13

Jaxon performs the squared transformation to the variable y.

He then fits a least squares line to the transformed data, with x as the explanatory variable.

Using this line, the predicted value for y when x is equal to 5 is closest to

A. 16 852

B. 361

C. 230

D. 182

E. 118

Question 14

The number of cars sold monthly by a local car dealership in 2017 are displayed in the table below.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Number of cars	125	114	86	75	68	89	120	105	95	78	92	118

Using three-mean smoothing, the smoothed number of cars sold in July is closest to

A. 89

B. 95

C. 104

D. 105

E. 120

Use the following information to answer Questions 15 and 16.

The seasonal indices for the number of cars sold by the car dealership are shown below.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Seasonal index	1.29	1.17		0.77	0.70	0.92	1.24	1.08	0.99	0.80	0.95	1.22

Question 15

The seasonal index for March is

A. 0.13

B. 0.67

C. 0.87

D. 0.93

E. 2.09

Question 16

If the deseasonalised predicted value for car sales in July 2019 is 99, the actual value for July 2019 is closest to

A. 79

B. 80

C. 87

D. 122

E. 123

Recursion and financial modelling

Use the following information to answer Question 17 and 18.

The value of a reducing balance loan, in dollars, after n months, V_n, can be modelled by the recurrence relation shown below.

$$V_0 = 50\,000, \qquad V_{n+1} = 1.00238\,V_n - 800$$

Question 17

The annual interest rate for this reducing balance loan is closest to

A. 1.23%

B. 1.24%

C. 1.98%

D. 2.38%

E. 2.86%

Question 18

The value of the reducing balance loan after 6 months is closest to

A. \$45 319

B. \$45 880

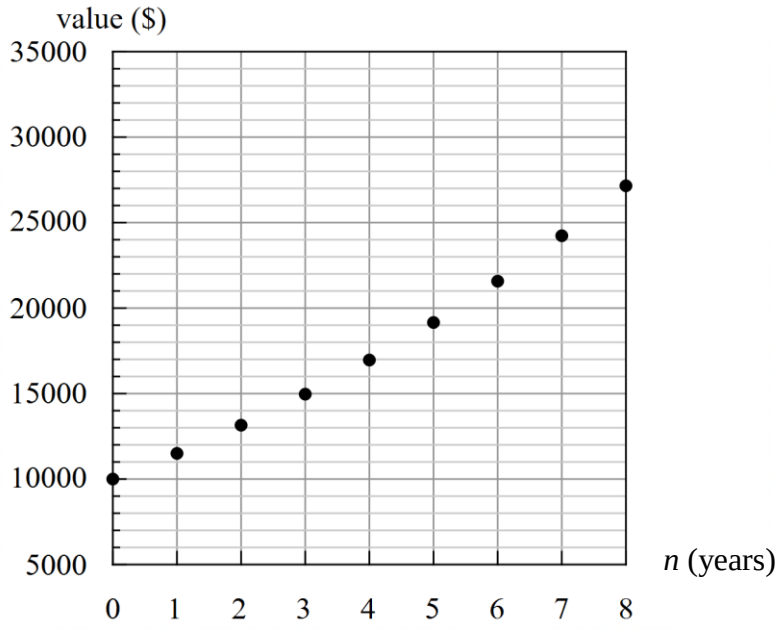
C. \$45 890

D. \$45 918

E. \$49 918

Question 19

The graph below shows the value, V_n, of an investment as it increases over eight years.



Which one of the following investments does this graph best represent?

A. a simple interest investment earning interest at a rate of 10% per annum

B. a compound interest investment earning interest at a rate of 10% per annum, with a yearly payment

C. a perpetuity earning interest at a rate of 103% per annum.

D. an annuity investment earning interest at a rate of 10% per annum, with a yearly withdrawal.

E. a compound interest investment earning interest at a rate of 10% per annum, with a yearly withdrawal

Question 20

Which one of the following recurrence relations could be used to model the value of a reducing balance loan with regular repayments, R_n, after *n* months?

A. $R_0 = 300\,000, \quad R_{n+1} = 0.996 \times R_n - 1250$

B. $R_0 = 300\,000, \quad R_{n+1} = 0.996 \times R_n + 1250$

C. $R_0 = 300\,000, \quad R_{n+1} = 1.004 \times R_n + 1250$

D. $R_0 = 300\,000, \quad R_{n+1} = R_n - 1250n$

E. $R_0 = 300\,000, \quad R_{n+1} = 1.004 \times R_n - 1250$

Question 21

A printer was purchased for $1200. After three years, the printer has a value of $765.

On average, 1740 pages were printed every year.

The value of the printer was depreciated using a unit cost method of depreciation.

The depreciation in the value of the printer, per page printed, is closest to

A. 5 cents.

B. 6 cents.

C. 7 cents.

D. 8 cents.

E. 9 cents.

Use the following information to answer Question 22 and 23.

Kate borrowed $425 000 to pay for her house, with the intention of repaying her loan within 10 years.

The interest rate for the first five years was 5.25% per annum, compounding monthly.

Kate made monthly repayments of $3100.

After five years, the interest rate changed to 4.95%.

Question 22

The amount of interest that Kate has paid in the first 5 years of her loan is closest to

A. $6258

B. $84 910

C. $101 090

D. $170 500

E. $186 000

Question 23

At the end of the sixth year, Kate still owes $319 256.

From the end of the sixth year, what will Kate's monthly repayment change to, when rounded to the nearest whole number, in order to repay her loan in 10 years?

A. $6017

B. $6061

C. $6720

D. $6725

E. $7345

Question 24

Four lines of an amortisation table for a reducing balance loan with monthly repayments are shown below.

Repayment number	Payment	Interest	Principal reduction	Balance of loan
13	2700	$1385.72	$1314.28	$348 762.17
14	2700	$1380.52	$1319.48	$347 442.69
15	2700	$1375.29	$1324.71	$346 117.98
16	2700			$344 788.03

The balance of the loan after repayment number 16 is $344 788.03.

The interest paid in the sixteenth payment is

A. $1235.76

B. $1329.95

C. $1370.05

D. $1570.61

E. $2700.00

END OF SECTION A
TURN OVER

SECTION B – Modules

Instructions for Section B

Select **two** modules and answer **all** questions within the selected modules in pencil on the answer sheet provided for multiple-choice questions.

Show the modules you are answering by shading the matching boxes on your multiple-choice answer sheet.

Choose the response that is **correct** for the question.

A correct answer scores 1; an incorrect answer scores 0.

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

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

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Contents **Page**

Module 1 – Matrices

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

Question 1

Belinda works at the local fish and chip shop. Her shifts vary between afternoon (*A*) and evening (*E*) shifts.

The matrix below shows the number of hours Belinda works across three weeks, and the type of shift she works.

$$\begin{matrix} & A & E \\ week\ 1 \\ week\ 2 \\ week\ 3 \end{matrix}\begin{bmatrix} 7 & 13 \\ 5 & 21 \\ 10 & 8 \end{bmatrix}$$

The number of evening hours that Belinda works across the three weeks is

A. 18

B. 20

C. 22

D. 26

E. 42

Question 2

Consider the following matrices.

$$A = \begin{bmatrix} 2 & 4 \\ 6 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 2 & 4 \\ -2 & 1 & 3 \\ 5 & 2 & 1 \end{bmatrix} \qquad C = \begin{bmatrix} 3 \\ 0 \\ 2 \end{bmatrix} \qquad D = \begin{bmatrix} 1 & 4 & 8 \end{bmatrix}$$

The number of matrices that have an inverse is

A. 0

B. 1

C. 2

D. 3

E. 4

Question 3

Micah (*M*), Brad (*B*), Leilani (*L*), Riya (*R*) and Saul (*S*) work together in a professional environment.

Micah, Brad and Saul are in a position of leadership, and therefore some of the office staff report to them.

The matrix below shows the working relationship between the staff.

$$\begin{array}{c} \\ M \\ B \\ L \\ R \\ S \end{array} \begin{array}{c} \begin{array}{ccccc} M & B & L & R & S \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

A ‘1’ in the matrix shows that the staff member in that row reports to the staff member in that column.

For example, the ‘1’ in the third row of the second column shows that Leilani reports to Brad.

A ‘0’ in the matrix shows that the staff member in that row works alongside the staff member named in that column but does not report them.

How many staff members does Brad report to?

A. 0

B. 1

C. 2

D. 3

E. 4

Question 4

The table below shows the type, number and price of each school notebook purchased by a family with five children at the beginning of the school year.

Notebook	**48-page A4**	**64-page A4**	**128-page A4**	**240-page A4**	**Musical lined A5**	**Journal A5**
Price	\$0.65	\$0.78	\$1.16	\$1.35	\$5.35	\$12.26
Number	12	10	8	6	10	5

The matrix product that displays the total cost of all notebooks purchased is

A. $\begin{bmatrix} 0.65 \\ 0.78 \\ 1.16 \\ 1.35 \\ 5.35 \\ 12.26 \end{bmatrix} \begin{bmatrix} 12 & 10 & 8 & 6 & 10 & 5 \end{bmatrix}$

B. $\begin{bmatrix} 0.65 \\ 0.78 \\ 1.16 \\ 1.35 \\ 5.35 \\ 12.26 \end{bmatrix} \begin{bmatrix} 12 \\ 10 \\ 8 \\ 6 \\ 10 \\ 5 \end{bmatrix}$

C. $\begin{bmatrix} 0.65 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.78 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.16 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1.35 & 0 & 0 \\ 0 & 0 & 0 & 0 & 5.35 & 0 \\ 0 & 0 & 0 & 0 & 0 & 12.26 \end{bmatrix} \begin{bmatrix} 12 & 10 & 8 & 6 & 10 & 5 \end{bmatrix}$

D. $\begin{bmatrix} 12 & 10 & 8 & 6 & 10 & 5 \end{bmatrix} \begin{bmatrix} 0.65 \\ 0.78 \\ 1.16 \\ 1.35 \\ 5.35 \\ 12.26 \end{bmatrix}$

E. $\begin{bmatrix} 12 & 10 & 8 & 6 & 10 & 5 \end{bmatrix} \begin{bmatrix} 0.65 & 0.78 & 1.16 & 1.35 & 5.35 & 12.26 \end{bmatrix}$

Question 5

$$\begin{bmatrix} 1 & -3 & 3 \\ 2 & 3 & -1 \\ 4 & -3 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -4 \\ 15 \\ 19 \end{bmatrix}$$

Using the matrix equation above, the numerical values of the variables x, y and z are

A. $x = 8,\ y = 18,\ z = 80$

B. $x = 5,\ y = 1,\ z = 2$

C. $x = -5,\ y = 1,\ z = -2$

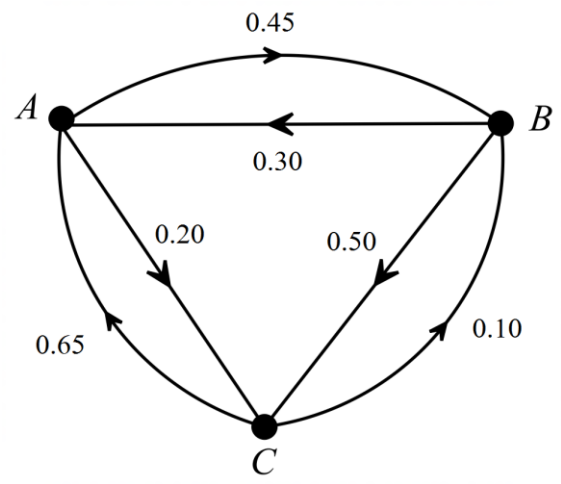
D. $x = 5,\ y = 1,\ z = -2$

E. unable to be determined from this matrix equation.

Question 6

The transition diagram below has been constructed from a transition matrix.

The labelling in the transition diagram is not yet complete.



The corresponding transition matrix, D, is represented by

A.

$$D = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 0.35 & 0.45 & 0.20 \\ 0.30 & 0.20 & 0.50 \\ 0.65 & 0.10 & 0.25 \end{bmatrix} \end{array} \begin{array}{l} \text{this year} \\ \\ \\ \\ \text{next year} \end{array}$$

B.

$$D = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 0.35 & 0.20 & 0.65 \\ 0.45 & 0.30 & 0.10 \\ 0.20 & 0.50 & 0.25 \end{bmatrix} \end{array} \begin{array}{l} \text{this year} \\ \\ \\ \\ \text{next year} \end{array}$$

C.

$$D = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 0.25 & 0.30 & 0.65 \\ 0.45 & 0.20 & 0.10 \\ 0.20 & 0.50 & 0.25 \end{bmatrix} \end{array} \begin{array}{l} \text{this year} \\ \\ \\ \\ \text{next year} \end{array}$$

D.

$$D = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 0.35 & 0.30 & 0.65 \\ 0.45 & 0.20 & 0.10 \\ 0.20 & 0.50 & 0.25 \end{bmatrix} \end{array} \begin{array}{l} \text{this year} \\ \\ \\ \\ \text{next year} \end{array}$$

E.

$$D = \begin{array}{c} \\ A \\ B \\ C \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 0.35 & 0.30 & 0.65 \\ 0.25 & 0.20 & 0.10 \\ 0.40 & 0.50 & 0.25 \end{bmatrix} \end{array} \begin{array}{l} \text{this year} \\ \\ \\ \\ \text{next year} \end{array}$$

Use the following information to answer Questions 7 and 8.

A mathematics teacher has a class of 28 students.

Each time the class sits a maths test, she records each student's mark (A, B, C, D or E) and the number of students who received each mark.

The expected number of students who will receive each grade can be determined by the matrix equation

$$G_{n+1} = T \times G_n$$

where

$$T = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} \multicolumn{5}{c}{\textit{this test}} \\ A & B & C & D & E \end{array} \\ \begin{bmatrix} 0.62 & 0.15 & 0.08 & 0.05 & 0.01 \\ 0.22 & 0.55 & 0.22 & 0.07 & 0.07 \\ 0.07 & 0.18 & 0.53 & 0.42 & 0.14 \\ 0.05 & 0.07 & 0.13 & 0.38 & 0.32 \\ 0.04 & 0.05 & 0.04 & 0.08 & 0.46 \end{bmatrix} \end{array} \begin{array}{l} \\ A \\ B \\ C \\ D \\ E \end{array} \quad \textit{next test}$$

The state matrix, G_4, shows the number of students who received each grade on the fourth maths test.

$$G_4 = \begin{bmatrix} 3 \\ 5 \\ 10 \\ 6 \\ 4 \end{bmatrix} \begin{array}{l} A \\ B \\ C \\ D \\ E \end{array}$$

Question 7

The number of students who received a B on the third maths test is closest to

A. 2

B. 3

C. 6

D. 7

E. 12

Question 8

In the long term, how many students can be expected to receive an A on their maths test?

A. 3

B. 4

C. 5

D. 6

E. 7

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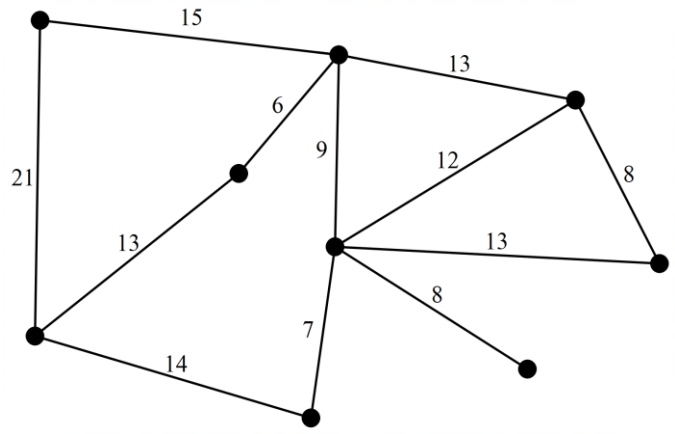
Module 2 – Networks and decision mathematics

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

Question 1

Consider the following network.



The length of the minimum spanning tree in this network is

A. 78

B. 79

C. 80

D. 84

E. 86

Question 2

A connected, planar graph has six edges.

This graph could have

A. four vertices and five faces.

B. four vertices and six faces.

C. four vertices and seven faces.

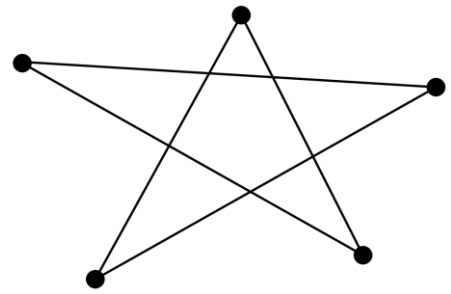
D. four vertices and four faces.

E. four vertices and three faces.

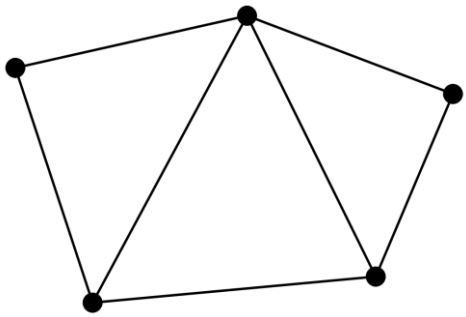
Question 3

Which of the following graphs is **not** a planar graph?

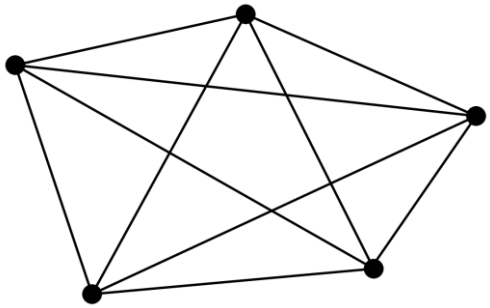
A.



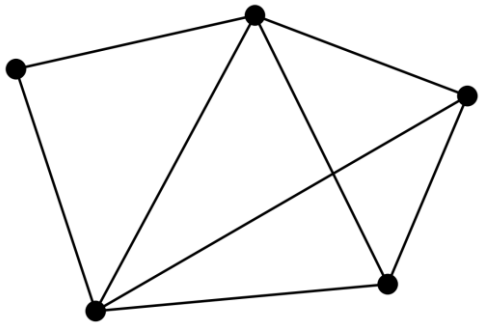
B.



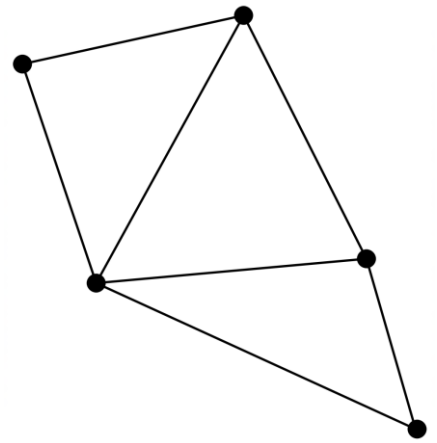
C.



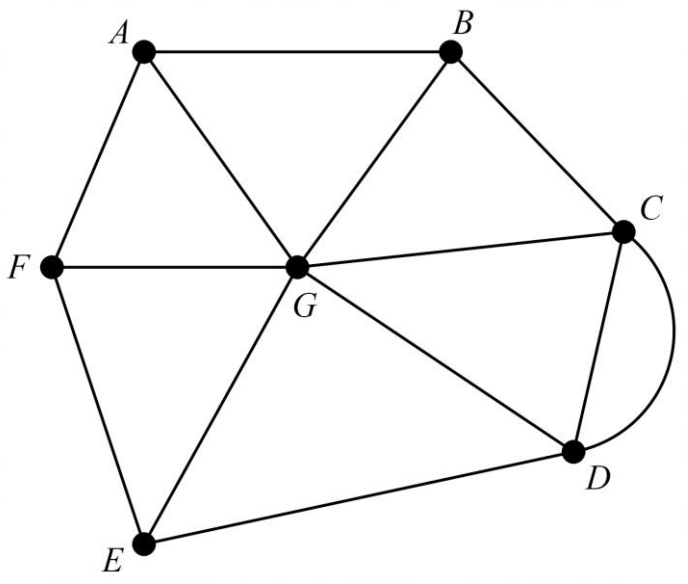
D.



E.



Question 4



An edge is to be added between two of the vertices in the network above.

In the resulting network, an Euler trail is still not possible.

Between which two vertices was the edge added?

A. A and B

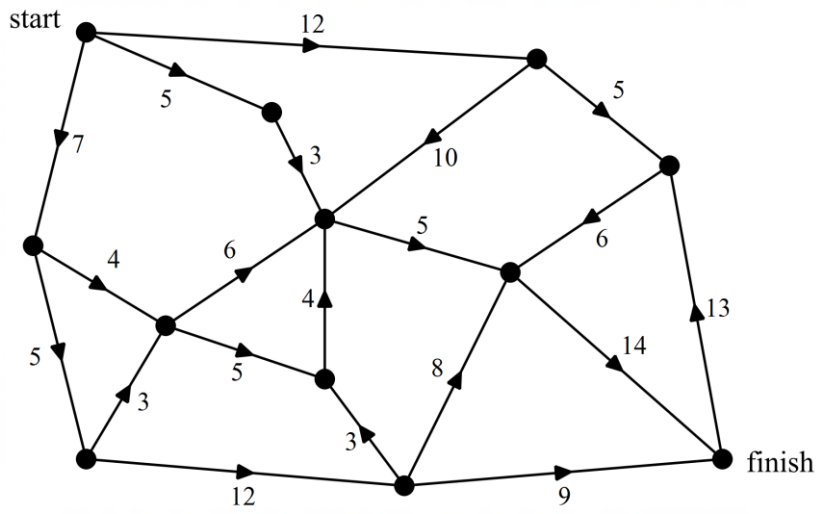
B. A and E

C. A and F

D. B and F

E. B and G

Question 5



The maximum flow for the directed graph above is

A. 13

B. 14

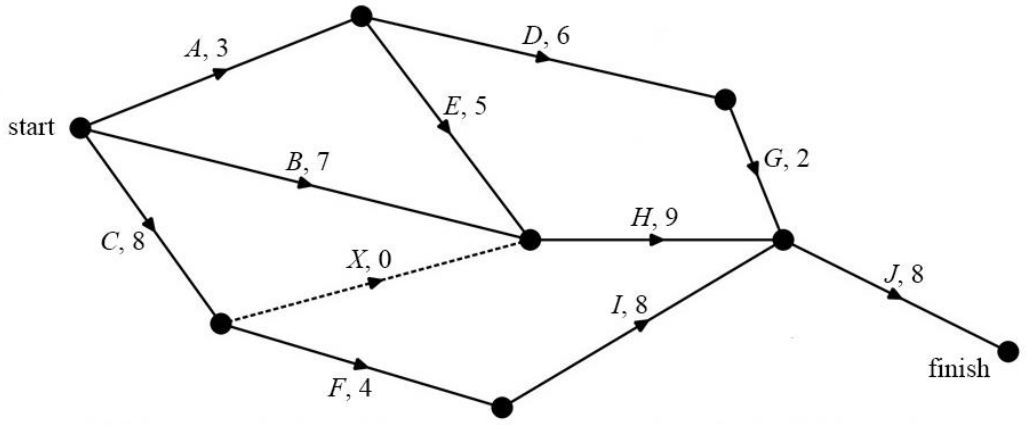
C. 15

D. 16

E. 17

Use the following information to answer Questions 6–8.

The directed network below shows the sequence of 10 activities that are needed to complete a project. The time, in days, that it takes to complete each activity is also shown.



Question 6

Which of the following activities is not a predecessor for activity H?

A. activity A

B. activity B

C. activity C

D. activity D

E. activity E

Question 7

The latest start time for activity D is

A. 3

B. 6

C. 8

D. 9

E. 12

Question 8

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

A. 19

B. 24

C. 25

D. 28

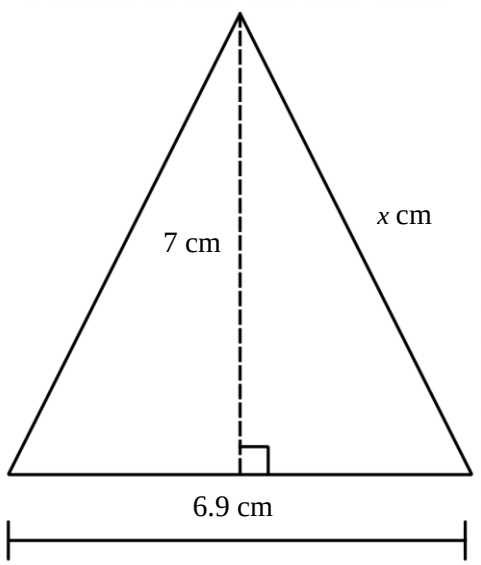
E. 31

Module 3 – Geometry and measurement

Before answering these questions, you must **shade** the 'Geometry and measurement' box on the answer sheet for multiple-choice questions.

Question 1

An isosceles triangle is shown below.



The length of the side marked x, correct to one decimal place, is

A. 1.2 cm

B. 6.1 cm

C. 7.2 cm

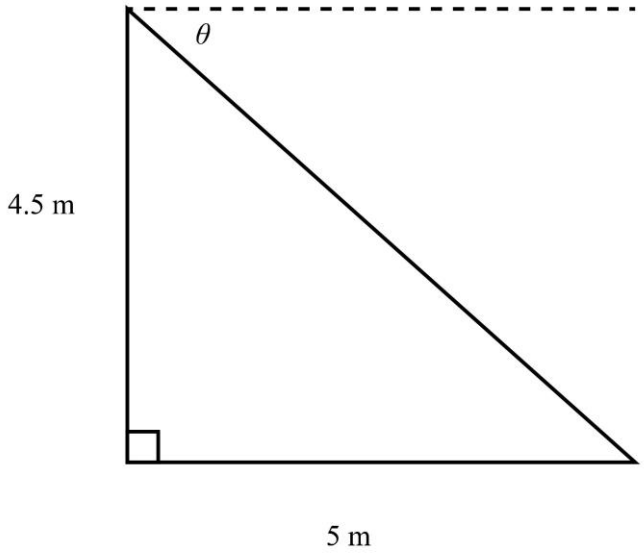
D. 7.8 cm

E. 9.8 cm

Question 2

A child stands on the top of a 4.5 metre high piece of play equipment and looks down at her mother, who is standing on the ground at a horizontal distance of 5 metres and is watching her.

The situation is illustrated using the triangle below.



What is the angle of depression, θ, for the child looking down at her mother?

A. 25°

B. 26°

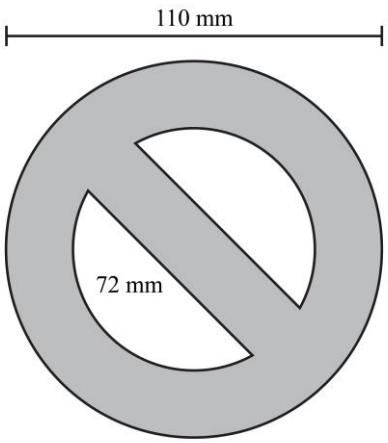
C. 41°

D. 42°

E. 64°

Question 3

The following sign will be placed around the local primary school to indicate areas that are out of bounds.



The area of the shaded section of this sign is closest to

A. 5430 mm^2

B. 5440 mm^2

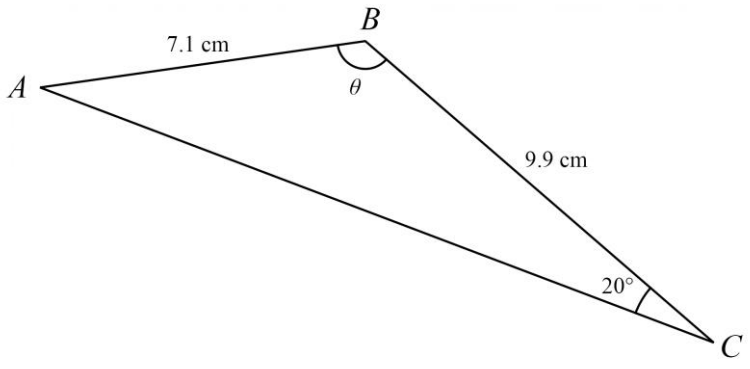
C. 21 720 mm^2

D. 21 710 mm^2

E. 33 940 mm^2

Question 4

A triangle *ABC* is shown below.



The value of the unknown angle, θ, to the nearest degree, is

A. 28°

B. 29°

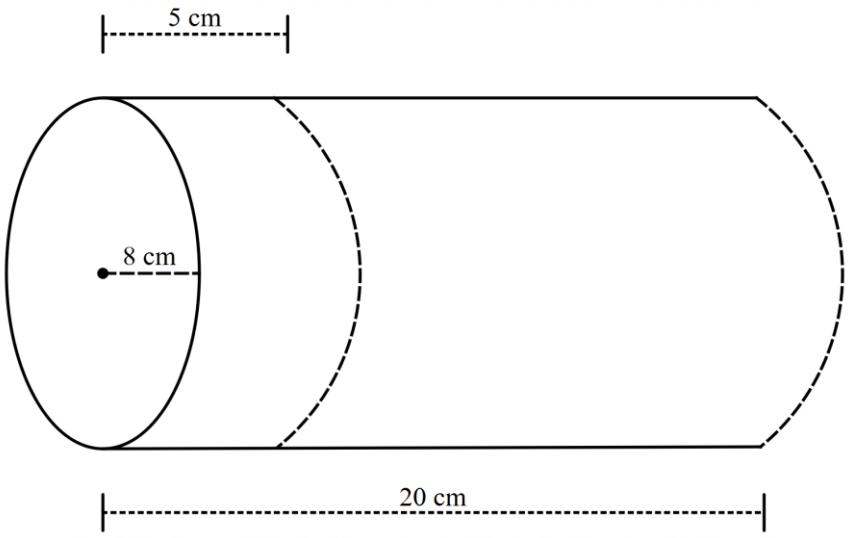
C. 90°

D. 130°

E. 132°

Question 5

A cake is baked in the shape of a cylinder, as shown below.



A chunk of cake is cut from the original, indicated by the dashed line on the diagram above. The remaining cake will be iced, including the ends.

What is the total surface area, to the nearest centimetre squared, that will be iced?

A. 804 cm^2

B. 1156 cm^2

C. 1407 cm^2

D. 3117 cm^2

E. 3619 cm^2

Question 6

The city of Dublin in Ireland is situated at a latitude of $53° \text{ N}$ and longitude of $6° \text{ W}$.
Assume that the radius of the Earth is 6400 km.

The shortest distance along the surface of the Earth between Dublin and the North Pole in kilometres is

A. 670

B. 4133

C. 5920

D. 9383

E. 10 053

Question 7

The sun is expected to set at 5.21 pm in Osaka, Japan $(35° \text{ N}, 136° \text{ E})$.

On the same day, the sun is expected to set in Kabul, Afghanistan $(35° \text{ N}, 67° \text{ E})$ approximately

A. at the same time.

B. 2 hours earlier.

C. 2 hours later.

D. 5 hours earlier.

E. 5 hours later.

Question 8

Benjamin is bushwalking.

He starts off on a bearing of $120° \text{ T}$ until he reaches a lake 10.2 km away.

He then walks 12.6 km on a bearing of $215° \text{ T}$ until he reaches a drinking fountain. Finally, Benjamin turns and walks directly north, back to the starting point.

The distance from the drinking fountain to the starting point, rounded to one decimal place, is

A. 7.3 km

B. 8.9 km

C. 10.9 km

D. 11.9 km

E. 15.5 km

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Module 4 – 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 equation of the line that passes through the points (1, 6) and (2, 8) is

A. $2x - 2y = -8$

B. $2x + y = -4$

C. $2x - 4y = -8$

D. $2x - y = -4$

E. $4x - 2y = 8$

Question 2

Mariana is a mechanic.

She charges her clients a fixed fee of $150 to provide a quote, plus $70 per hour for labour.

The equation that represents the total amount, $\$C$, that Mariana charges for t hours of work on a car is

A. $C = 70t$

B. $C = 150t$

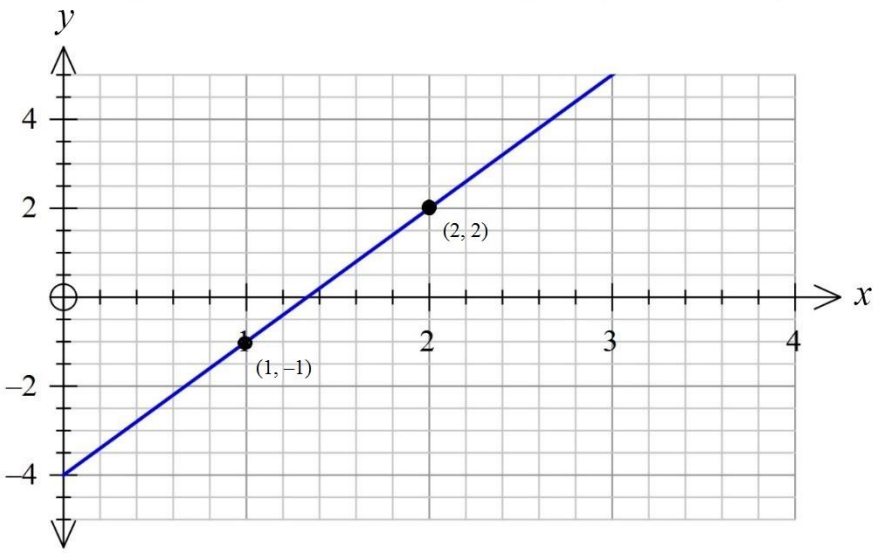
C. $C = 220t$

D. $C = 70t + 150$

E. $C = 150t + 70$

Question 3

Consider the following graph.



The equation of this line is

A. $y = -3x - 4$

B. $y = 3x - 4$

C. $y = 3x + 4$

D. $y = -3x + 4$

E. $y = 4x - 3$

Question 4

A fast-food restaurant sells small and large serves of fries.

Let x represent the cost of a small serve of fries, and y represent the cost of a large serve.

Two families dine at the restaurant.

The Jackson family purchase 2 small and 2 large fries for a total cost of $64.

The Learner family purchase 4 small and 1 large fries for a total cost of $62.

The cost of one serve of small fries is

A. $6

B. $8

C. $10

D. $12

E. $18

Question 5

The three inequalities below were used to construct a feasible region for a linear programming problem.

$$x > 3$$
$$y \leq 10$$
$$x + y < 15$$

Which of the following points does not lie within this feasible region?

A. (4, 6)

B. (5, 8)

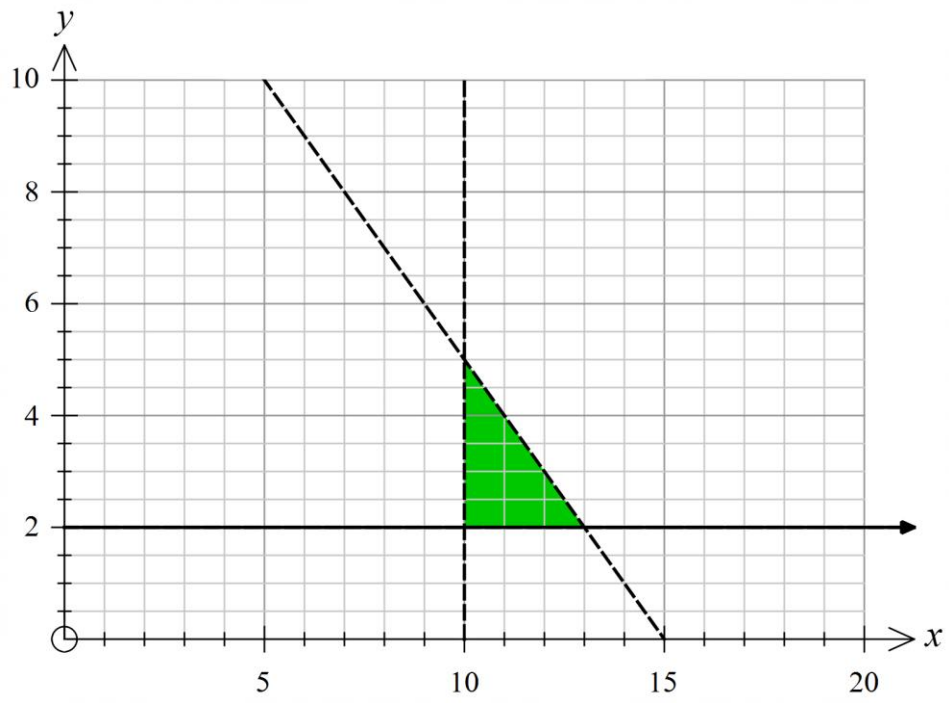
C. (6, 4)

D. (7, 9)

E. (8, 3)

Question 6

The graph below shows the shaded region (with boundaries included) that represents the feasible region for a linear programming problem.



The following constraints are plotted on the graph:

Constraint 1: $x > 10$

Constraint 2: $y \geq 2$

Constraint 3: $x + y$ ___ 15

To complete Constraint 3, which symbol is required?

A. $<$

B. $>$

C. $=$

D. $\leq$

E. $\geq$

Question 7

An artist charges for her work based on the area in square centimetres, s, of the artwork she is asked to produce.

Her costs are represented by the function below.

$$C = \begin{cases} 5s & 0 < s < 100 \\ 50 + 15s & 100 \leq s < 350 \\ 100 + 17s & 350 \leq s < 500 \\ 20s & s \geq 500 \end{cases}$$

Christine commissions two pieces of art.

The first is a rectangle with dimensions 15 cm by 12 cm.

The second is a square, with sides of 25 cm in length.

The total cost for both of Christine's pieces is

A. \$11 500

B. \$12 500

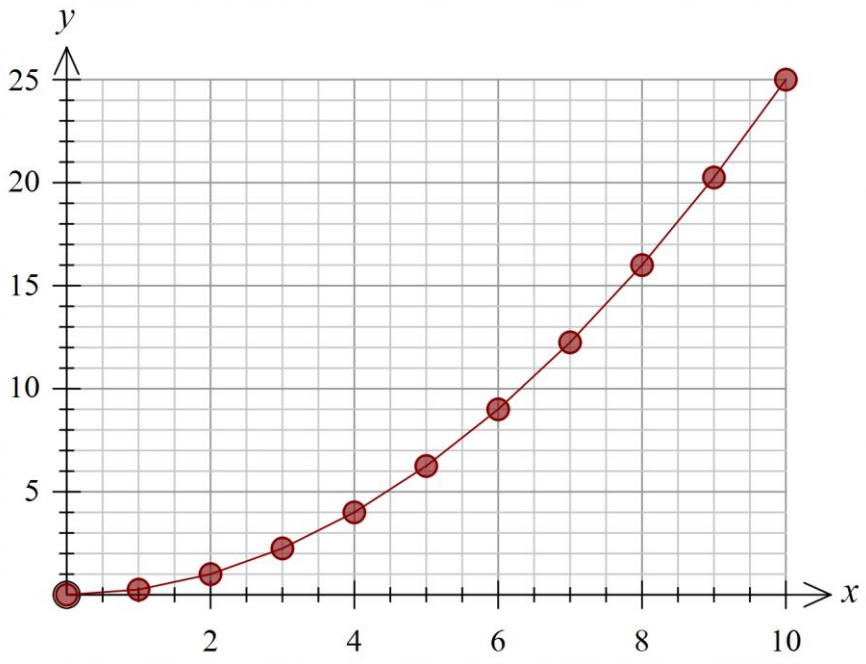
C. \$12 600

D. \$13 000

E. \$15 250

Question 8

The graph of $y = kx^2$ is shown below.



The value of k is

A. 1

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. 10

E. 25

END OF MULTIPLE-CHOICE QUESTION BOOK