

Section B

Specific instructions for Section B

Section **B** consists of 5 modules. Each module contains 9 questions.

You should select **3 modules** and answer **all** questions within the modules selected on the answer sheet provided for multiple choice questions. Indicate each module selected on the answer sheet for multiple choice questions by ticking the corresponding box.

A correct answer scores 1, an incorrect answer scores 0. No mark will be given for a question if two or more letters are circled for that question. Marks will not be deducted for incorrect answers and you should attempt every question within each module selected.

Module 1 : Number patterns and applications

Question 1

The first three terms of a sequence are 3, 1 and -1 . Another term in this sequence is -21 . This term is the

- A 9th term
- B 10th term
- C 11th term
- D 12th term
- E 13th term

Question 2

Which one of the following is a geometric sequence?

- A $a, 2a, 3a, 4a, \dots$
- B $a + 1, 2a + 2, 3a + 3, 4a + 4, \dots$
- C $a, a - 1, a - 2, a - 3, \dots$
- D $a + 2, 2a + 4, 4a + 8, 8a + 16, \dots$
- E $a, -a, 2a, -2a, \dots$

Question 3

Vince earned \$47 000 in 2003 but will take a 10.5% pay cut in 2004. To determine his new salary Vince would multiply his 2003 salary by

- A 0.895
- B 0.105
- C 1.105
- D 10.5
- E 89.5

Question 4

Gear A rotates at 4 revolutions per minute and gear B rotates at 3 revolutions per minute. If gear A has 12 cogs then the number of cogs that gear B has will be

- A 3
- B 4
- C 9
- D 12
- E 16

Question 5

At a party, Simon ate 5 meat balls in the first hour. Each hour after that he increased the number of meatballs he ate by a given number. If he ate 75 meatballs in a 6 hour period, then the increase per hour was

- A 1
- B 2
- C 3
- D 4
- E 5

Question 6

The difference equation $t_{n+1} = at_n - 3$ where $t_1 = 2$ generates a sequence.

Given that the second term of this sequence is -5 , then the value of a will be

- A -5
- B -4
- C -1
- D 2
- E 5

Question 7

Katrina added a very large number of terms of a geometric sequence together and found that the sum of the terms was approaching a value of 6. If the first term of this sequence is 4 then the common ratio, r , must be

- A $\frac{1}{4}$
- B $\frac{1}{3}$
- C $\frac{1}{2}$
- D $\frac{2}{3}$
- E $\frac{3}{2}$

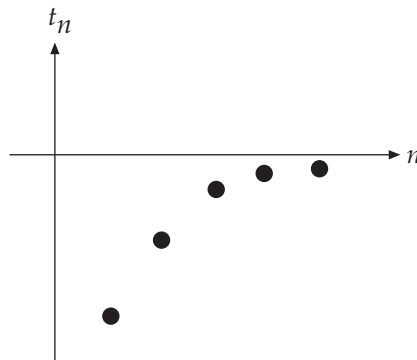
Question 8

Charles offers to distribute a sum of money to his three children, Tom, Dick and Harry, in the ratio $5 : 3 : 2$. Dick decides to forfeit his share and divides his money equally between Tom and Harry. Ultimately the money given by Charles has been divided between Tom and Harry in the ratio

- A $5 : 2$
- B $2 : 1$
- C $13 : 7$
- D $4 : 3$
- E $1 : 1$

Question 9

The first five terms of a sequence were plotted and the arrangement of points was noted.

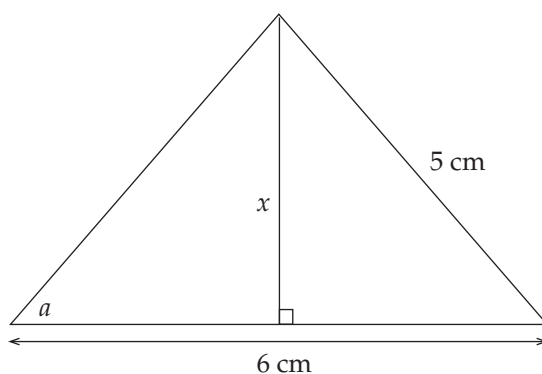


This sequence is most likely to be

- A geometric with $r > 1$
- B geometric with $0 < r < 1$
- C geometric with $r < 0$
- D arithmetic with $d > 0$
- E arithmetic with $d < 0$

Module 2 : Geometry and trigonometry

The following diagram relates to Questions 1 and 2.

**Question 1**

Given that the triangle is isosceles, the length of side x , in centimetres, is

- A 2
- B 2.5
- C 3
- D 4
- E 4.5

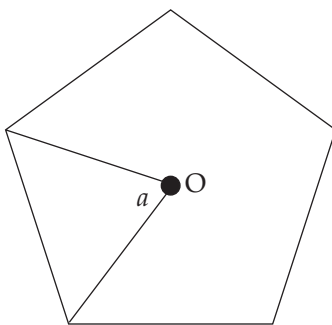
Question 2

The magnitude of angle a , correct to the nearest degree, is

- A 26°
- B 37°
- C 45°
- D 53°
- E 90°

Question 3

The diagram below is of a regular pentagon with centre O.

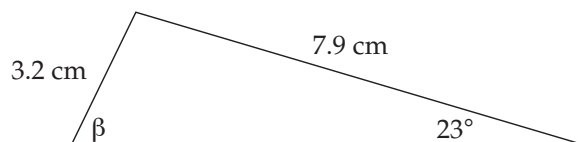


The magnitude of angle a is

- A 90°
- B 72°
- C 60°
- D 45°
- E 36°

Question 4

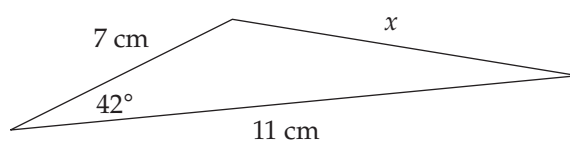
Consider the following triangle.



The magnitude of angle β , correct to the nearest degree, is

- A 46°
- B 56°
- C 70°
- D 75°
- E 83°

The following diagram relates to Questions 5 and 6.



Question 5

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

- A 8.1 cm
- B 7.5 cm
- C 7.0 cm
- D 5.1 cm
- E 3.5 cm

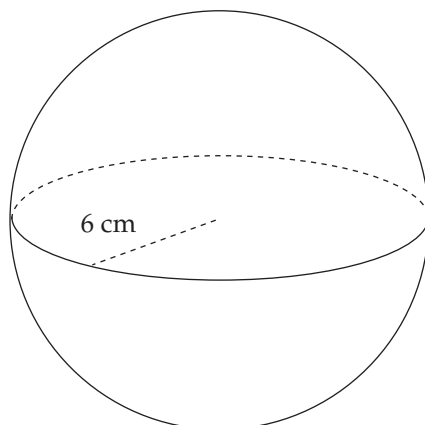
Question 6

The area, in square centimetres, of the triangle shown can be determined by evaluating

- A $\frac{1}{2} \times 7 \times 11$
- B $\frac{1}{2} \times 7 \times 11 \times \cos 42^\circ$
- C $\frac{1}{2} \times 7 \times 11 \times \sin 42^\circ$
- D $7 \times 11 \times \cos 42^\circ$
- E $7 \times 11 \times \sin 42^\circ$

The following information relates to Questions 7 and 8.

The given diagram is of a sphere with radius 6 cm.



Question 7

The volume of this sphere, to the nearest cubic centimetre, is

- A 113
- B 151
- C 216
- D 226
- E 905

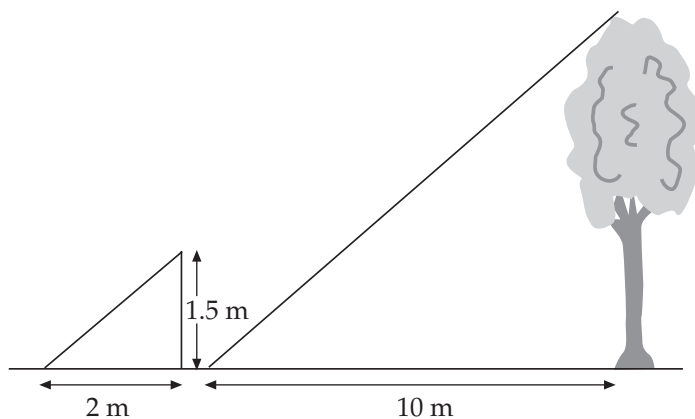
Question 8

A second similar sphere has a volume which is eight times the volume of the sphere shown.
The radius of the second sphere is

- A 12 cm
- B 24 cm
- C 48 cm
- D 64 cm
- E 192 cm

Question 9

The following diagram shows similar triangles with dimensions as marked.



The height of the tree, in metres, is

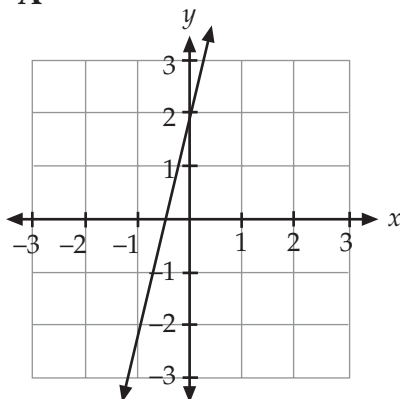
- A 6
- B 7.5
- C 9
- D 12
- E 13.5

Module 3 : Graphs and relations

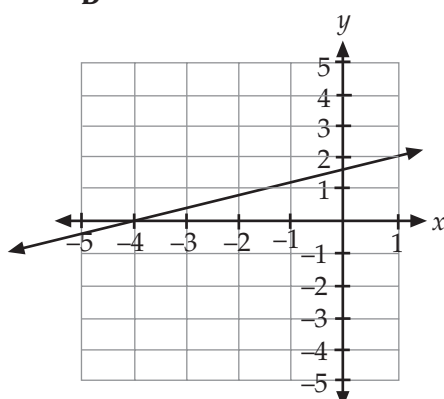
Question 1

The graph of the linear function $4x - 9y + 15 = 0$ is

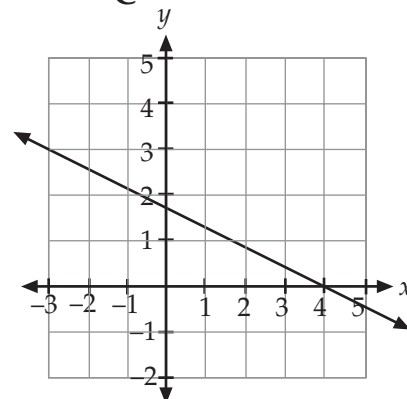
A



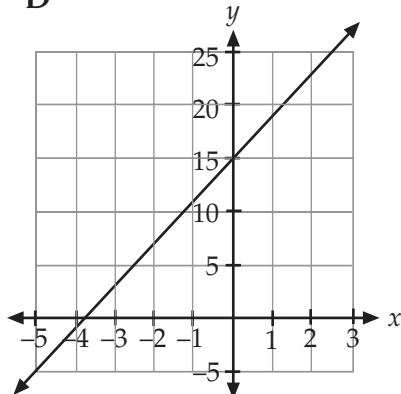
B



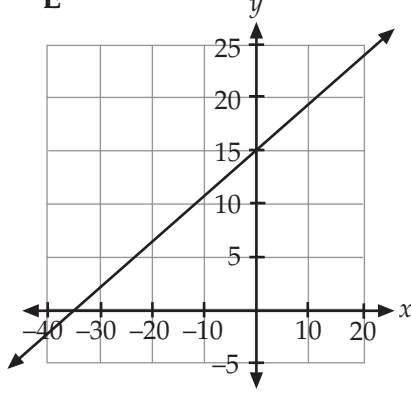
C



D



E



Question 2

For the pair of simultaneous equations

$$2x + 3y = 2 \quad \text{and} \quad 5y = 7 - 4x$$

the solution is

A $x = 5.5, \quad y = 3$

B $x = -2, \quad y = -3$

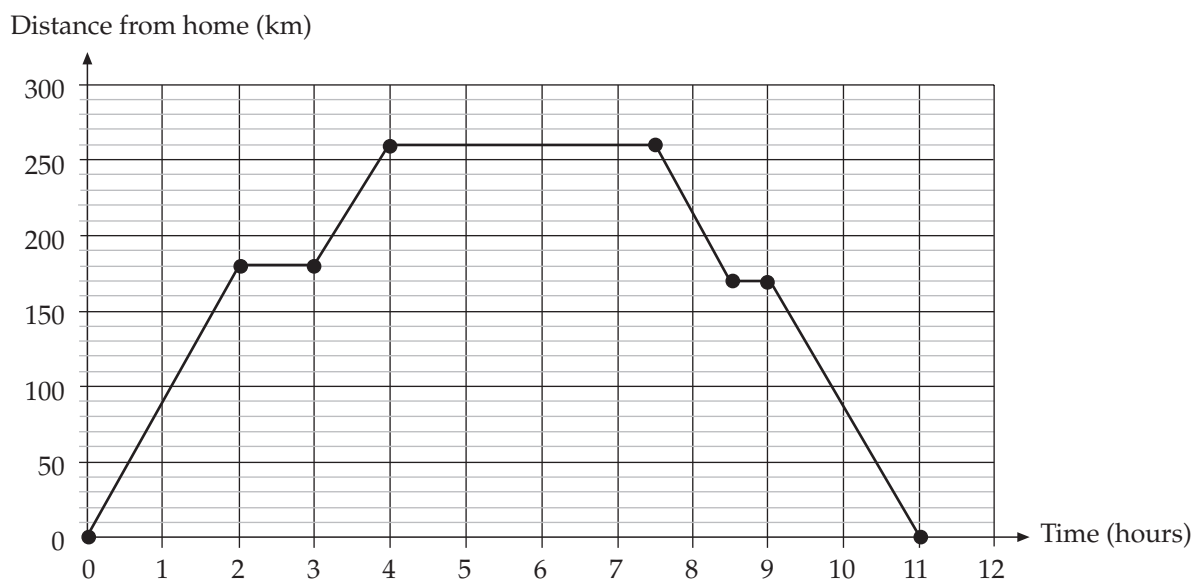
C $x = 5.5, \quad y = -3$

D $x = 3, \quad y = 1$

E $x = \frac{13}{7}, \quad y = -\frac{4}{7}$

The following information relates to Questions 3 and 4.

Sue and Roger have taken a trip to a national park, 260 kilometres from their home and the following graph outlines the distance from their home for the duration of the trip.



Question 3

Sue's mobile phone is out of range when they are more than 120 kilometres from home. The time that Sue's mobile phone is out of range during this trip is closest to

- A 2.3 hours
- B 2.7 hours
- C 8.3 hours
- D 8.7 hours
- E 9.3 hours

Question 4

The average speed, in kilometres/hour, over the first four hours of Sue's and Roger's trip to the national park is

- A 65
- B 80
- C 85
- D $86\frac{2}{3}$
- E 90

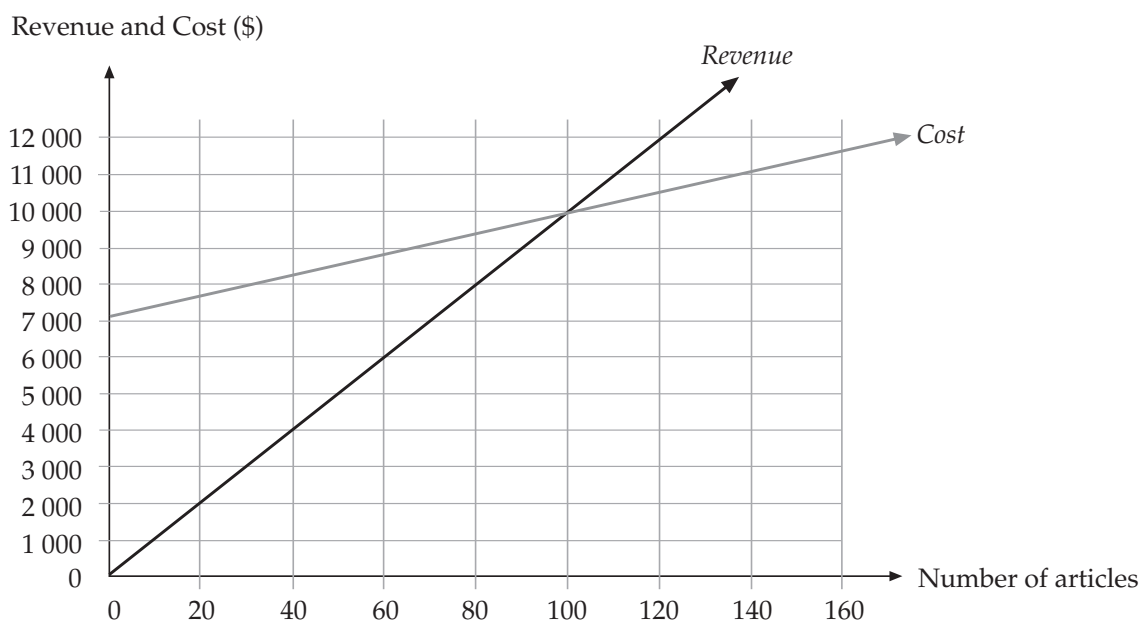
The following information relates to Questions 5 and 6.

Graphed on the set of axes below are the Cost and Revenue functions for the manufacture of a particular article.

The cost function consists of a set amount, \$7 200, relating to the cost of setting-up the manufacturing process, plus an amount for materials for producing each of the articles.

The manufacturer sells all the articles that he makes for \$96 each.

He has found that he will break-even if he produces and sells 100 articles.



Question 5

The cost of materials, in dollars, for manufacturing each of the articles is

- A 24
- B 48
- C 72
- D 75
- E 96

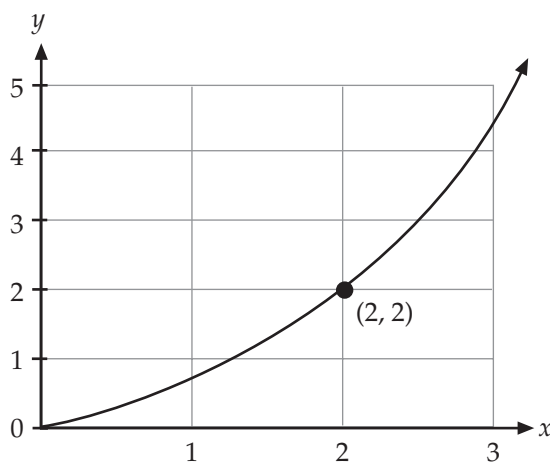
Question 6

Which one of the following would **not** be true for the manufacture of these articles?

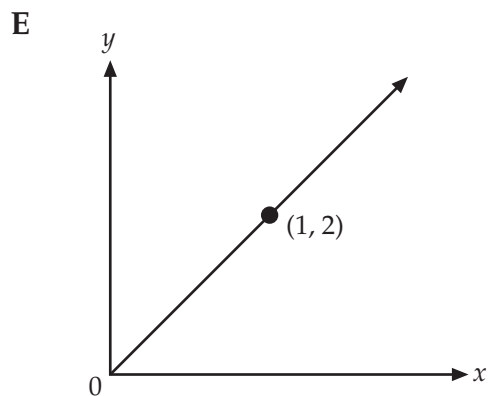
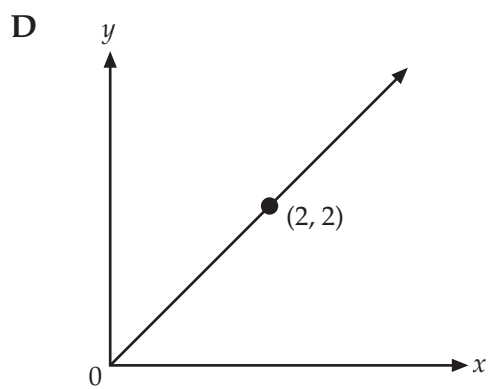
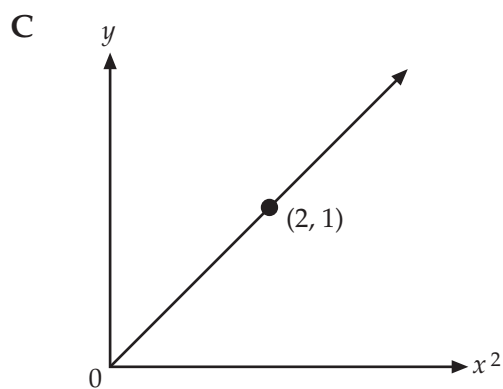
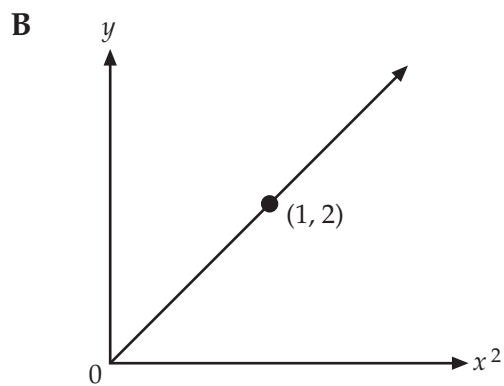
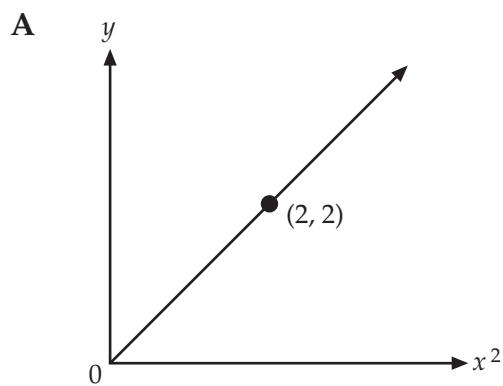
- A The manufacturer would need to spend more than \$9 600 to make a profit.
- B If the manufacturer produces and sells fewer than 100 articles then he will make a loss.
- C The profit made from selling 120 articles is \$4 320.
- D The loss made from making and selling 80 articles is more than \$1 000.
- E If the manufacturer increases his selling price to \$99 then he will need to sell fewer articles to break-even.

Question 7

The following is the graph of a function with equation of the form $y = kx^2$.



Which one of the following graphs represents the same function?



Question 8

The following inequations define a region in the x - y plane.

$$x \geq 2$$

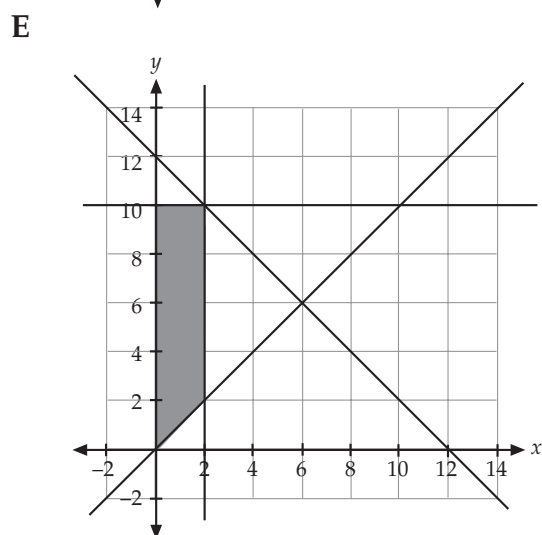
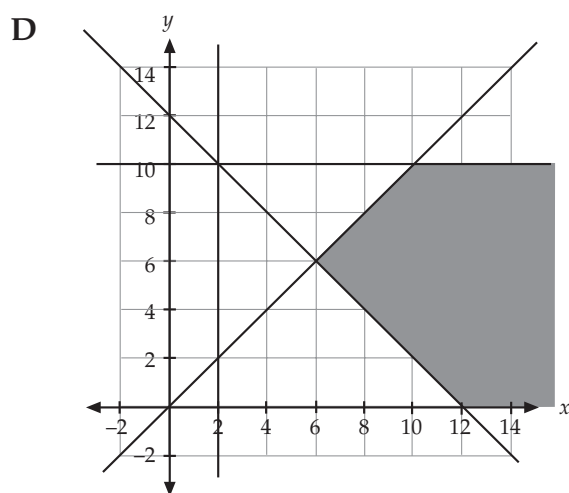
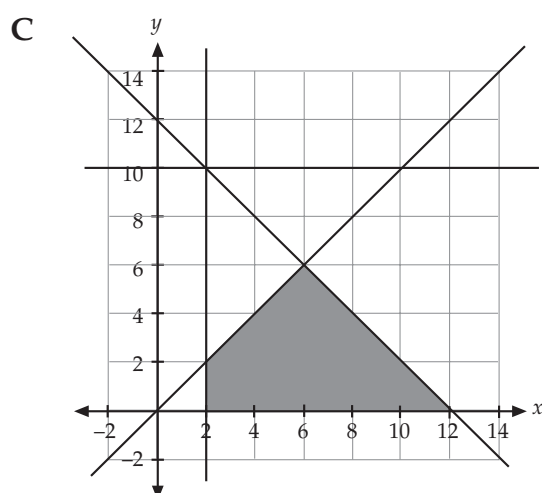
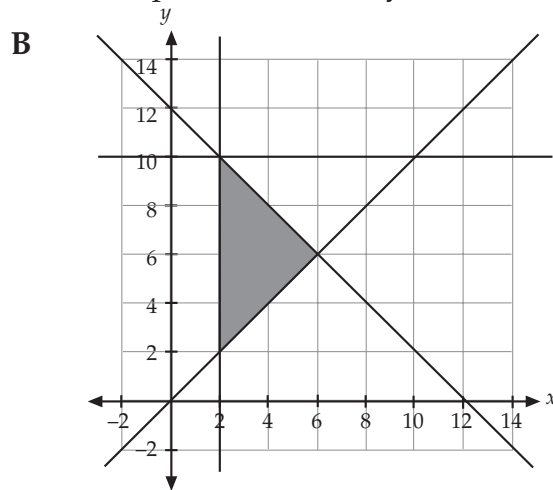
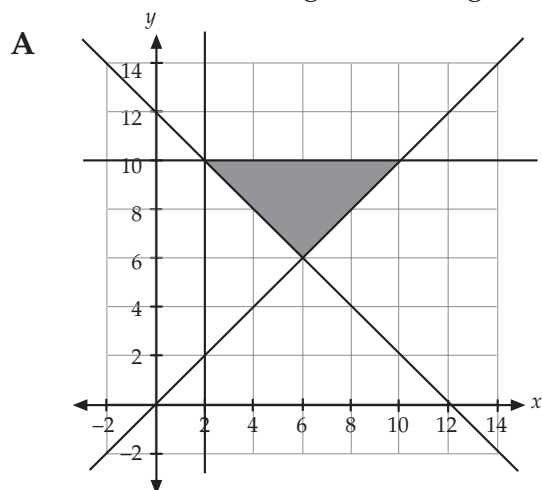
$$y \leq 10$$

$$x + y \leq 12$$

$$y \geq x$$

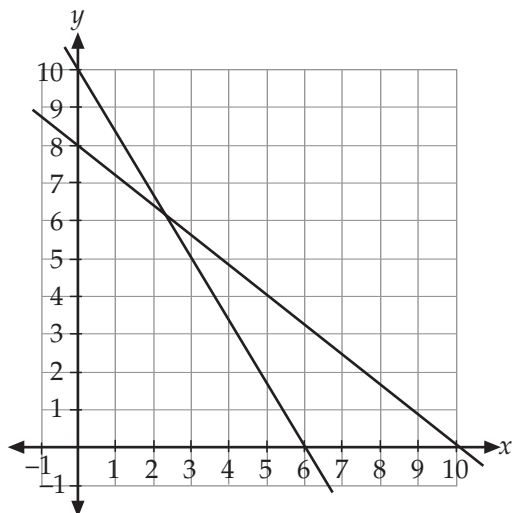
$$y \geq 0$$

Which one of the following shaded regions represents the points that satisfy all the inequations?



Question 9

In the diagram below the boundary lines for a linear programming problem, defined by the inequations $5x + 3y \leq 30$, $4x + 5y \leq 40$, $x \geq 0$, $y \geq 0$, have been drawn.



If only whole number solutions are possible for x and y , then the maximum value of the objective function $8x + 5y$ will occur at the point

- A $(6, 0)$
- B $(2\frac{1}{3}, 6\frac{1}{3})$
- C $(2, 6)$
- D $(2, 7)$
- E $(3, 5)$

Module 4 : Business related mathematics**Question 1**

Pembe has invested her \$8 400 savings for a period of three months in a term deposit account earning 4.8% p.a., interest payable at the end of the three month period.

The value of her investment after the three month period is

- A \$1 209.60
- B \$8 500.80
- C \$8 520.96
- D \$8 534.40
- E \$9 609.60

Question 2

A capital item, purchased for \$6 400, depreciates by 40% each year. If the item is replaced when its value falls below \$500 this will occur after year

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

Question 3

The original price of an article is reduced by 25% at the Summer Sale. It remains unsold and a month later the article is offered for sale at “50% off the already reduced price”.

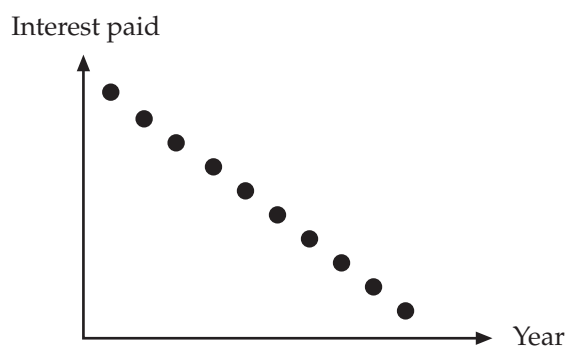
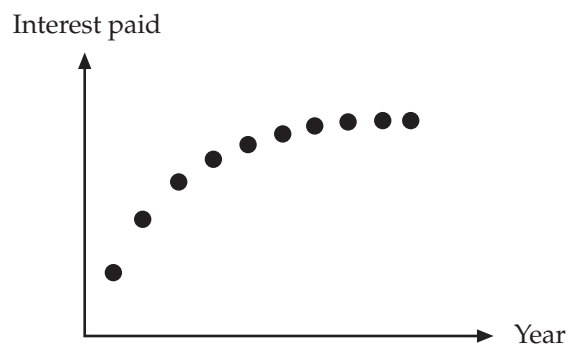
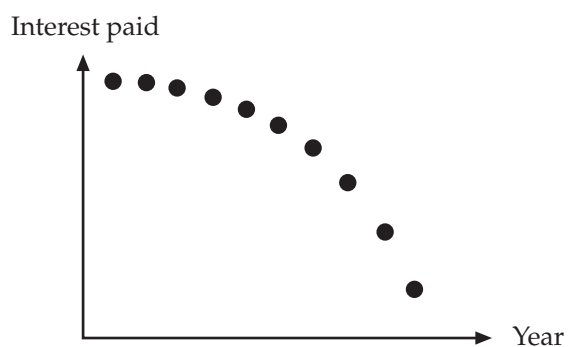
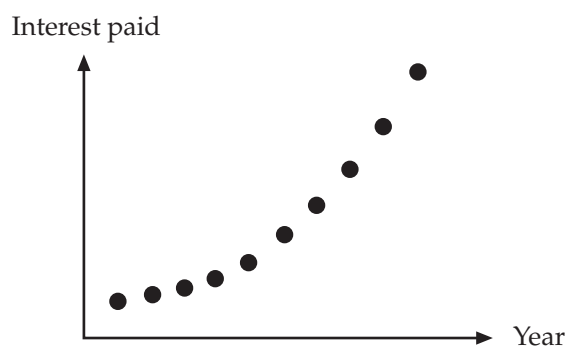
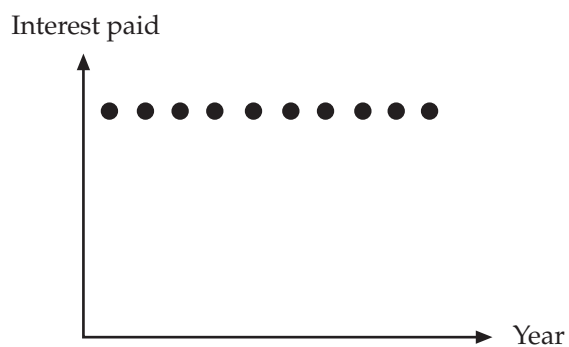
The overall percentage reduction on the original price of this article at this later sale is closest to

- A 12.5%
- B 37.5%
- C 62.5%
- D 75%
- E 87.5%

Question 4

A house is purchased using a reducing balance loan that is to be repaid over 10 years.

Which one of the following graphs best represents the yearly interest payments for this loan?

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

Question 5

A home theatre system, that has a selling price of \$6 000, can be purchased with a hire-purchase agreement that requires a 10% deposit of \$600, then twelve monthly payments of \$522.

The flat rate of interest that is being charged for this agreement is closest to

- A 4.4%
- B 4.9%
- C 14.4%
- D 16%
- E 28.3%

Question 6

Adam has an investment account at the bank where he has already saved \$7 200. He wishes to add a set amount to this account each month so that he has accumulated a total of \$20 000 in three years time. The investment account is paying 4.8% p.a. compounding monthly.

Which one of the following substitutions in the annuities formula can be used to calculate the amount, Q , that he will need to add to the account each month?

- A $20\,000 = 7\,200 \times 1.048^3 - \frac{Q(1.048^3 - 1)}{1.048 - 1}$
- B $20\,000 = 7\,200 \times 1.012^{12} - \frac{Q(1.012^{12} - 1)}{1.012 - 1}$
- C $20\,000 = 7\,200 \times 1.004^{36} - \frac{Q(1.004^{36} - 1)}{1.004 - 1}$
- D $20\,000 = 7\,200 \times 1.048^3 + \frac{Q(1.048^3 - 1)}{1.048 - 1}$
- E $20\,000 = 7\,200 \times 1.004^{36} + \frac{Q(1.004^{36} - 1)}{1.004 - 1}$

Question 7

Arun has borrowed \$6 000 and he is being charged 8.5% p.a. compound interest on the loan payable at the end of each year.

At the end of the first year, after the interest has been charged, he repays \$1 000.

The amount that Arun owes at the end of the second year is

- A \$5 531.65
- B \$5 938.35
- C \$5 978.35
- D \$6 020.00
- E \$6 063.35

Question 8

Seng has invested \$25 000 in an investment account earning 6.4% interest per annum, compounding quarterly.

The interest earned, in dollars, after n years is given by

- A $25\,000 - 25\,000 \times 1.016^{4n}$
- B $25\,000 \times 1.064^{4n} - 25\,000$
- C $25\,000 \times 1.064^n - 25\,000$
- D $25\,000 - 25\,000 \times 1.016^n$
- E $25\,000 \times 1.016^{4n} - 25\,000$

Question 9

Colleen has borrowed \$150 000 with a reducing balance loan charging 6.25% p.a.

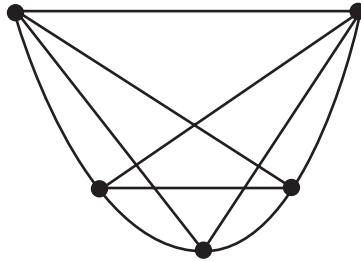
If she takes the loan for 25 years then 2 she will repay \$989.50 per month (12 payments per year).

If Colleen decides to repay the loan with 26 fortnightly payments per year of \$495, then the term of the loan will be reduced by approximately

- A 2.3 years
- B 2.4 years
- C 3.9 years
- D 4 years
- E 4.1 years

Module 5 : Networks and decision mathematics**Question 1**

The graph shown below is called



- A a complete graph
- B an incomplete graph
- C a planar graph
- D a quadratic graph
- E a regular graph

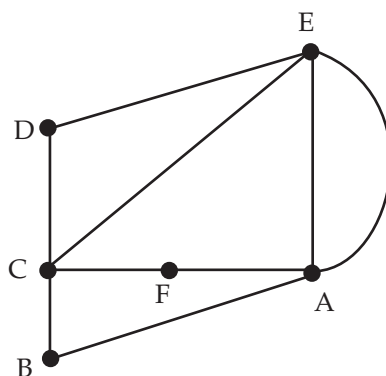
Question 2

The number of edges in the graph from Question 1 is

- A 6
- B 10
- C 12
- D 16
- E 20

Question 3

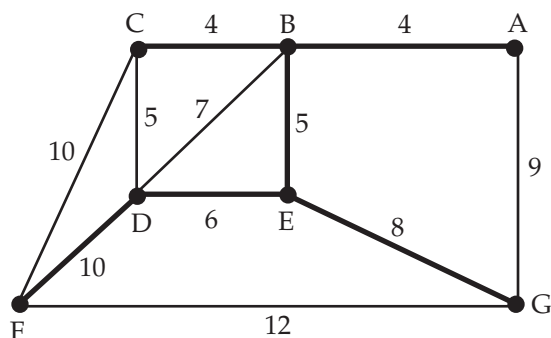
An Euler circuit for the graph shown below could be



- A A – B – C – D – E – F – A
- B A – F – C – D – E – B – A
- C A – B – C – D – E – C – F – A
- D A – B – C – D – E – C – F – A – E – A
- E There is no possible Euler circuit

Question 4

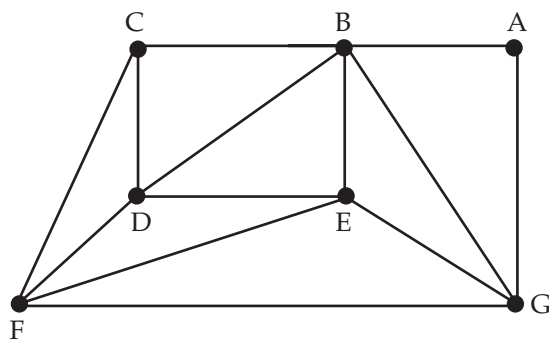
In the figure below, the numbers represent distances (in kilometres) between the seven shopping malls (vertices). The path in bold is



- A a shortest path
- B a bipartite path
- C a Hamiltonian path
- D a Eulerian path
- E a minimal spanning tree

Question 5

The network below has a Hamiltonian path which begins $A - G - E - B \dots$

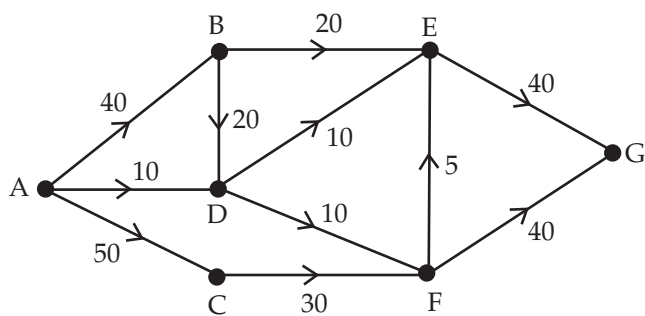


The next possible vertex could be

- A C only
- B D only
- C E only
- D C or E
- E C or D

Question 6

The maximum flow through the network shown below is



- A 70
- B 75
- C 80
- D 90
- E 100

Question 7

The following matrix shows the time (in minutes) quoted by four nursery truck drivers for delivering four loads of topsoil between local suburban nurseries and four customers' homes.

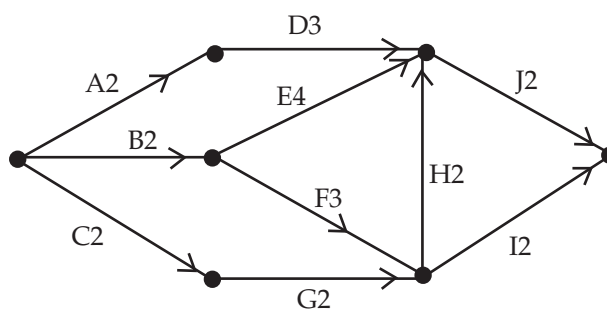
	Customer A	Customer B	Customer C	Customer D
Truck 1	20	10	20	15
Truck 2	5	15	10	25
Truck 3	15	10	5	10
Truck 4	10	10	20	20

The allocation which minimises the total time required, if each driver gets 1 job, is

- A** Truck 1 gets Customer D,
Truck 2 gets Customer A,
Truck 3 gets Customer C,
Truck 4 gets Customer B
- B** Truck 1 gets Customer B,
Truck 2 gets Customer A,
Truck 3 gets Customer C,
Truck 4 gets Customer D
- C** Truck 1 gets Customer D,
Truck 2 gets Customer A,
Truck 3 gets Customer B,
Truck 4 gets Customer C
- D** Truck 1 gets Customer C,
Truck 2 gets Customer A,
Truck 3 gets Customer B,
Truck 4 gets Customer D
- E** Truck 1 gets Customer B,
Truck 2 gets Customer A,
Truck 3 gets Customer D,
Truck 4 gets Customer C

The following network diagram refers to Questions 8 and 9.

Times for each activity are shown in days.



Question 8

Activities which must be completed before Activity I can begin are

- A F
- B G
- C F and G
- D F, G and H
- E C and G

Question 9

The earliest completion time for the entire project is

- A 6 days
- B 7 days
- C 8 days
- D 9 days
- E 10 days