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FURTHER MATHEMATICS

WRITTEN TRIAL EXAMINATION 1

2007

Reading Time: 15 minutes
Writing time: 1 hour 30 minutes

Instructions to students

This exam consists of Section A and Section B.
Section A contains 13 multiple-choice questions from the core, 'Data Analysis'.
Section A is compulsory and is worth 13 marks.
Section B consists of 6 modules each containing 9 multiple-choice questions. You should choose 3 of these modules and answer every question in each of your chosen modules.
Each of the modules is worth 9 marks.
Section B begins on page 8 of this exam.
There is a total of 40 marks available for this exam.
Unless otherwise stated the diagrams in this exam are not drawn to scale.
Students may bring one bound reference into the exam.
An approved graphics or CAS calculator may be used in the exam.
An answer sheet appears on page 37 of this exam.
Formula sheets can be found on pages 35 and 36 of this exam.

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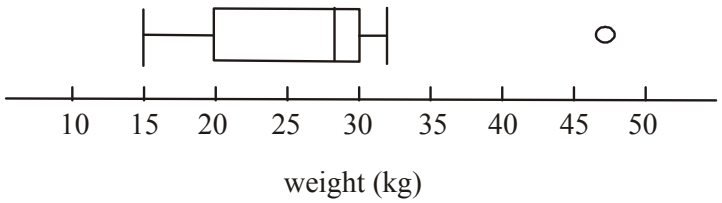
SECTION A

CORE

This section is compulsory.

The following information relates to questions 1 and 2.

The weight (in kg) of a class of Year 1 students is shown on the box plot below.



Question 1

The data represented by the box plot shown above is best described as

A. negatively skewed
B. bell shaped
C. symmetric
D. increasing
E. positively skewed.

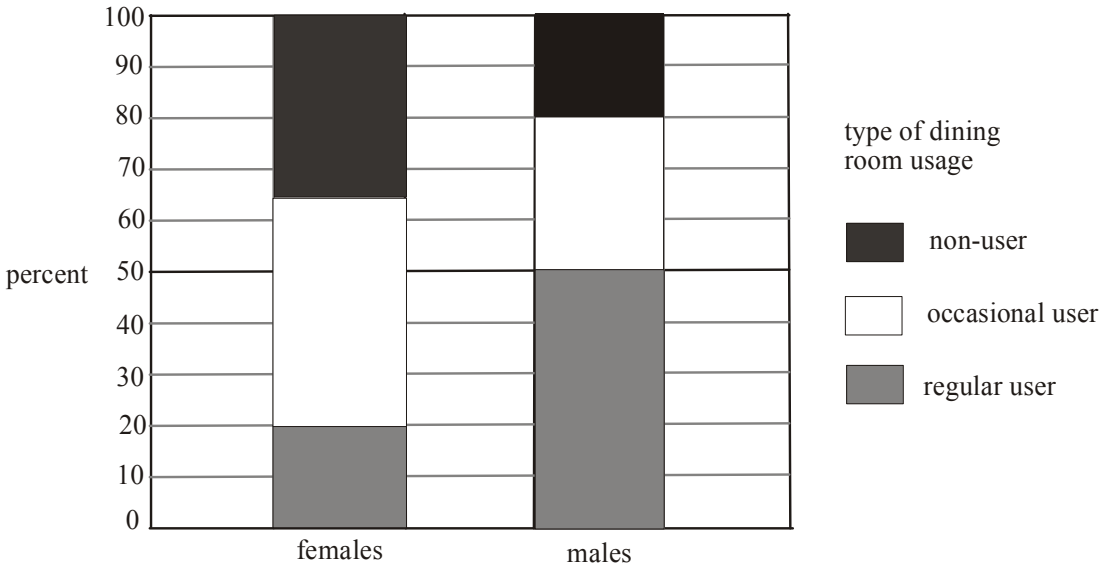
Question 2

The data value 47, has been correctly identified as a possible outlier because it is

A. less than 50
B. greater than 32
C. greater than 35
D. greater than 40
E. greater than 45

The information below relates to Questions 3 and 4.

The segmented bar chart below shows the distribution of the type of dining room usage compared to gender for a large group of members of a sporting club.



Question 3

The two variables in the distribution are

A. both numerical
B. both categorical
C. numerical and categorical
D. discrete and numerical
E. continuous and categorical

Question 4

The percentage of female members at the sporting club who make occasional use of the dining room is

A. 20%
B. 30%
C. 35%
D. 45%
E. 50%

Question 5

The time taken for a large group of managers to complete a questionnaire is normally distributed with a mean of 32 minutes and a standard deviation of 3 minutes. Out of a random selection of forty of these managers how many would you expect to have taken less than 26 minutes?

A. 1
B. 2.5
C. 3
D. 5
E. 6.4

Question 6

The load size (in kg) and the price (in dollars) of washing machines on display at a store are shown in the table below.

load size (kg)	4.5	5	5	7.5	6	7	6.5	7	5.5
price ($'s)	675	720	699	920	850	899	820	845	769

The Pearson product moment correlation coefficient for this data is closest to

A. 0.7978
B. 0.9193
C. 0.9588
D. 0.9878
E. 79.77

Question 7

A set of bivariate data with variables x and y has the following properties:

$$r = 0 \cdot 9489, \quad \bar{x} = 8 \cdot 4, \quad s_x = 1 \cdot 3, \quad \bar{y} = 17 \cdot 6, \text{ and } \quad s_y = 2 \cdot 1$$

The equation of the least squares regression line is nearest to

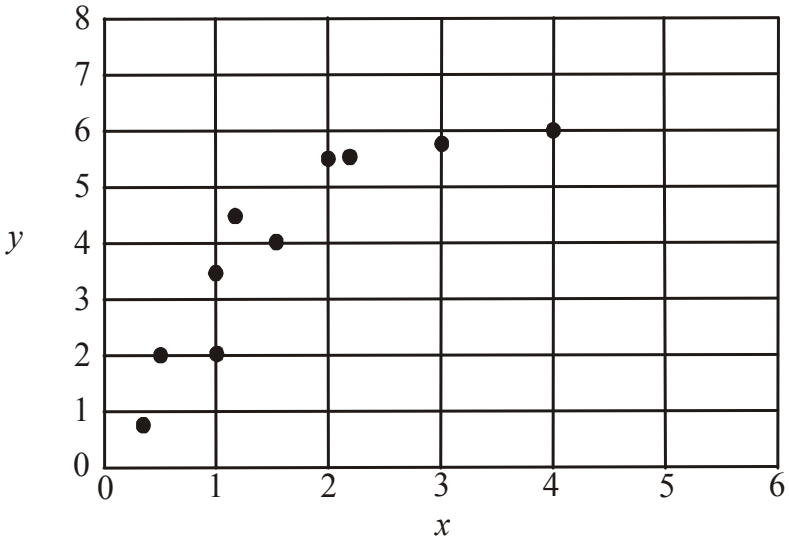
A. $y = -24 \cdot 2 + 4 \cdot 9x$
B. $y = -1 \cdot 9 + 0 \cdot 6x$
C. $y = 4.72 + 1 \cdot 53x$
D. $y = 12 \cdot 7 + 0 \cdot 6x$
E. $y = 30 \cdot 9 - 1 \cdot 52x$

The information below relates to questions 8 and 9.

A table of bivariate data with variables x and y is shown below.

x	0.3	0.5	1	1	1.2	1.5	2	2.2	3	4
y	0.8	2	2	3.5	4.5	4	5.5	5.5	5.8	6

This data is plotted on the scatterplot as shown below.



In order to linearise the data, it is transformed using a y^2 transformation.
A least squares regression line is fitted to the **transformed** data and its equation is given by

$$y^2 = 1 \cdot 17 + 10 \cdot 51x$$

Question 8

Which other transformation would be appropriate to use in order to linearise the data?

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

B. $\log x$ or $\frac{1}{y}$

C. $\log x$ or $\frac{1}{x}$

D. $\log y$ or $\frac{1}{x}$

E. $\log y$ or y^2

Question 9

The equation of least squares regression line for the **transformed** data is used to predict the y^2 values. For the piece of data with an x value of 0.5, the residual value is closest to.

A. – 4.425
B. – 2.425
C. 0
D. 2.425
E. 4.425

Question 10

The monthly sales of new cars at a dealership are shown in the table below.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number of sales	37	42	34	27	23	21	18	27	35	32	41	49

Using the five moving mean method, the smoothed value for the number of sales of new cars in June is

A. 12.4
B. 18
C. 20.7
D. 23.2
E. 387.

The information below relates to Question 11 - 13.

The seasonal index for the number of patients presenting at an emergency department of a hospital is shown in the table below.

Season	Summer	Autumn	Winter	Spring
Seasonal index	0.9	0.8	1.6	

Question 11

The seasonal index for the number of patients presenting in spring is

A. 0.3
B. 0.6
C. 0.7
D. 0.8
E. 3.3

Question 12

The number of patients presenting at the emergency department during winter is typically

A. 6% below the quarterly average
B. 6% above the quarterly average
C. 16% above the quarterly average
D. 60% below the quarterly average
E. 60% above the quarterly average

Question 13

A trend line that can be used to forecast, is fitted to the deseasonalised quarterly number of patients presenting at the emergency department.
It is given by

$$\text{deseasonalised number of patients} = 4\,890 - 87.2 \times \text{quarter number}$$

where quarter 1 represents summer in 2007.

The actual number of patients forecast to present at the emergency department in winter 2008 is closest to

A. 2 675
B. 4 280
C. 4 750
D. 6 847
E. 6 987

SECTION B

Module 1: Number patterns

If you choose this module all questions must be answered.

Question 1

The common ratio, r, in the geometric sequence

$$8,\ -2,\ 0\cdot5,\ -0\cdot125...$$

is

A. – 4
B. – 0.4
C. – 0.25
D. 0.25
E. 4

Question 2

In an arithmetic sequence the third term is 25 and the fifth term is 55.
The first term is

A. – 25
B. – 5
C. 5
D. 40
E. 85

Question 3

Natalie shoots 2 goals in the first week of netball competition. In the second week she shoots 5 and in the third week she shoots 8. If this pattern was to continue the total number of goals she would shoot over the ten week competition would be

A. 120
B. 155
C. 170
D. 310
E. 59

Question 4

For the difference equation defined by

$$t_n = t_{n-1} + 3t_{n-2} \text{ where } t_1 = 1 \text{ and } t_2 = 2,$$

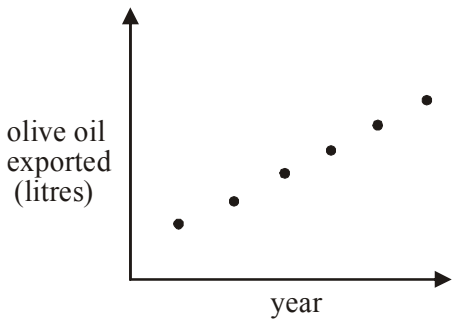
the sequence that is generated is

A. 1, 2, 3, 5, 8,…
B. 1, 2, 5, 11, 26, …
C. 1, 2, 5, 17, 38, …
D. 1, 2, 7, 11, 44,…
E. 1, 2, 7, 25, 46, …

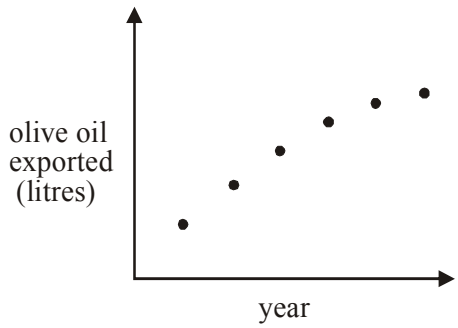
Question 5

An Australian olive oil producer increases exports of the product each year by 10%.
Which one of the following graphs shows best the change in the amount of olive oil that the producer is exporting?

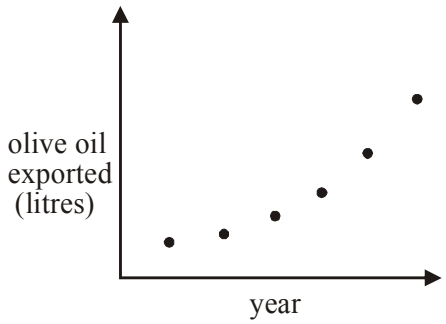
A.



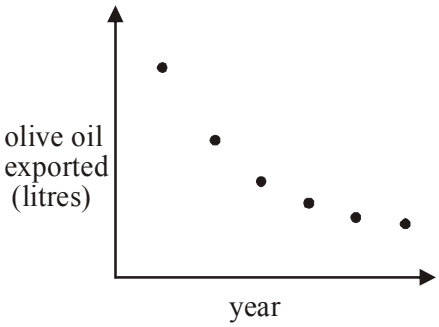
B.



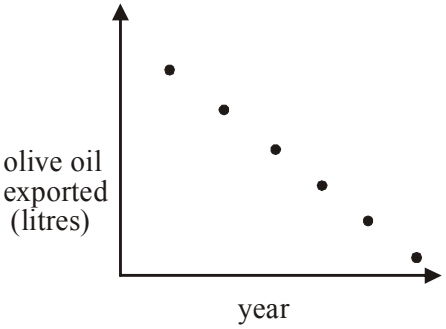
C.



D.

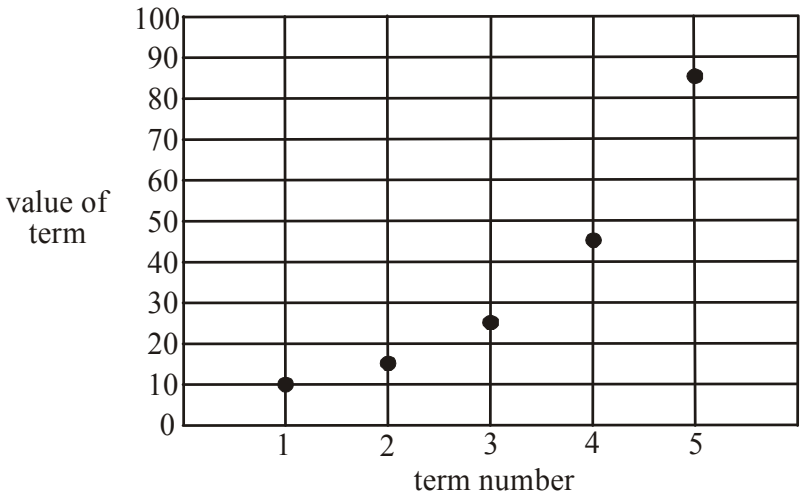


E.



Question 6

The first five terms of a sequence are plotted on the graph below.



A first order difference equation that could represent this sequence is

A. $t_{n+1} = 1 \cdot 5t_n, \quad t_1 = 10$
B. $t_{n+1} = t_n + 5, \quad t_1 = 10$
C. $t_{n+1} = t_n + 10, \quad t_1 = 10$
D. $t_{n+1} = 2t_n - 5, \quad t_1 = 10$
E. $t_{n+1} = 2t_n - 10, \quad t_1 = 10$

Question 7

The n^{th} term of the sequence defined by the difference equation

$$t_{n+1} = 4t_n \text{ where } t_1 = 5$$

is given by

A. $t_n = 4n$
B. $t_n = 4n + 1$
C. $t_n = 5 \times (4)^n$
D. $t_n = 4 \times (5)^{n-1}$
E. $t_n = 5 \times (4)^{n-1}$

Question 8

A family of four reduce the amount of water they use each week in their home.
In the first week they save 840 litres, in the second they save 168 litres and in the third they save 33.6 litres.
If this pattern continues, the amount of water they will save in litres over the long term will be

A. 1 050
B. 1 680
C. 2 340
D. 3 240
E. 4 200

Question 9

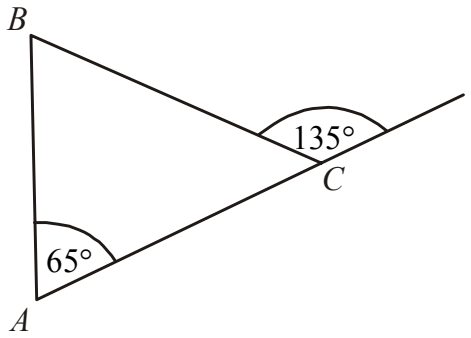
Each year the number of dogs owned by a dog breeder increased by 40%. At the end of every year she sold 5 dogs. At the end of her first year she owned 15 dogs. If D_n represents the number of dogs owned by the dog breeder at the end of the n^{th} year then a difference equation that describes this situation is given by

A. $D_{n+1} = D_n - 5, \quad D_1 = 15$
B. $D_{n+1} = 0 \cdot 4D_n - 5, \quad D_1 = 15$
C. $D_{n+1} = 0 \cdot 4(D_n - 5), \quad D_1 = 15$
D. $D_{n+1} = 1 \cdot 4(D_n - 5), \quad D_1 = 15$
E. $D_{n+1} = 1 \cdot 4D_n - 5, \quad D_1 = 15$

Module 2: Geometry and trigonometry

If you choose this module all questions must be answered.

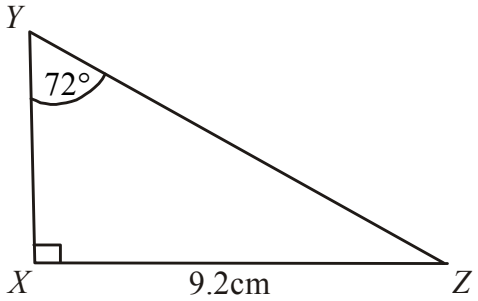
Question 1



The size of angle *ABC* is

A. 35°
B. 45°
C. 70°
D. 75°
E. 80°

Question 2

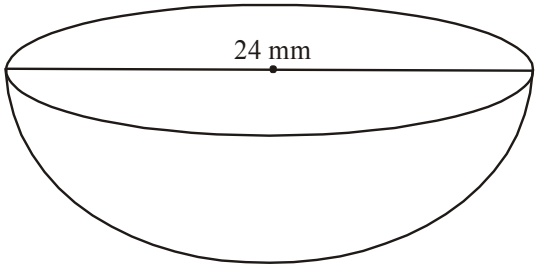


In triangle *XYZ*, the length of *YZ* in cm is closest to

A. 2.8
B. 3
C. 8.7
D. 9.7
E. 13.2

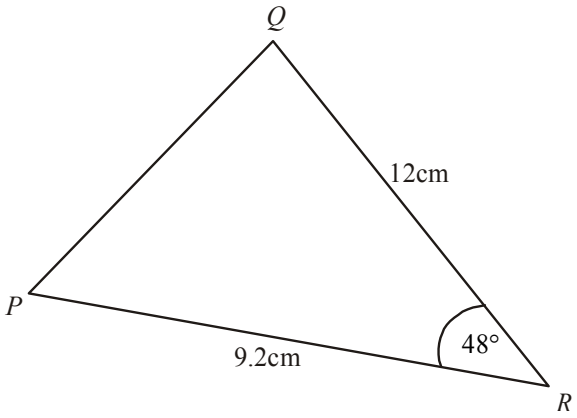
Question 3

A solid chocolate ball with diameter 24mm, is cut in half. The surface area of one of the halves, in square mm is closest to



A. 905
B. 980
C. 1 357
D. 2 262
E. 5 429

Question 4



The area in cm^2 of triangle *PQR*, shown above, is closest to

A. 37
B. 41
C. 61
D. 74
E. 82

Question 5

From a wharf, *W*, a yacht, *Y*, is due west. From the same wharf a ship, *S*, has a bearing of 310°. The bearing of the ship, *S*, from the yacht, *Y*, is 065°. The size of angle *WSY* is

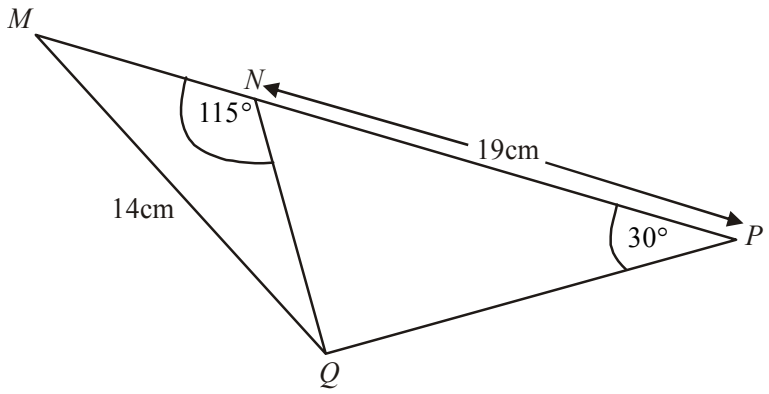
A. 75°
B. 105°
C. 115°
D. 125°
E. 245°

Question 6

The three sidelengths of a triangle are 12cm, 24cm and 27cm. Another triangle has a sidelength of 4cm on its shortest side, and is similar to the larger triangle. The perimeter of this smaller triangle, in cm, is

A. 16
B. 19
C. 21
D. 22
E. 25

Question 7



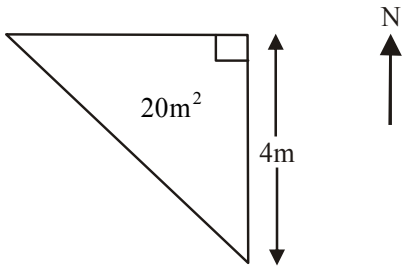
In ΔMPQ, $MQ = 14$ cm and $\angle MPQ = 30°$. The point N lies on MP where $NP = 19$ cm and $\angle MNQ = 115°$.

The length of NQ is equal to

A. $19\sin(30^\circ)$
B. $19\sin(65^\circ)$
C. $\sqrt{19^2 - 14^2}$
D. $\sqrt{19^2 - 14^2 - 532\cos(30^\circ)}$
E. $\dfrac{9 \cdot 5}{\sin(85^\circ)}$

Question 8

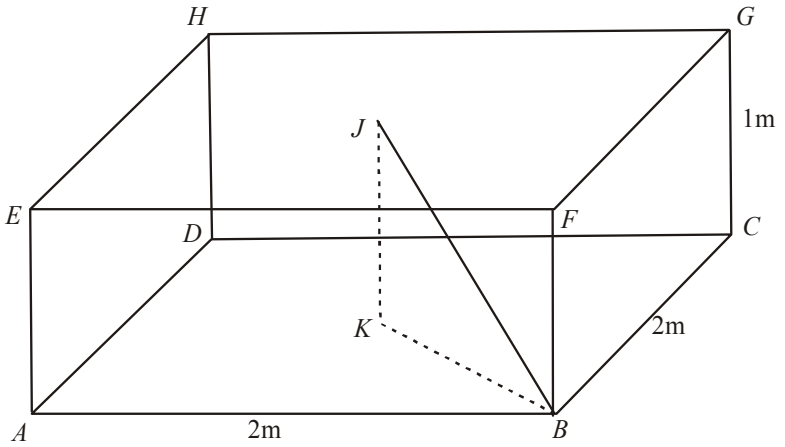
At a site office, a model of a new housing development is in the shape of a right angled triangle with the eastern border of length 4m. The area of the model is 20m^2.



The actual area of land covered by the new housing development is $18\,000\text{m}^2$.
The eastern border of the actual land would have a length in metres of

A. 30
B. 80
C. 120
D. 900
E. 3 600

Question 9



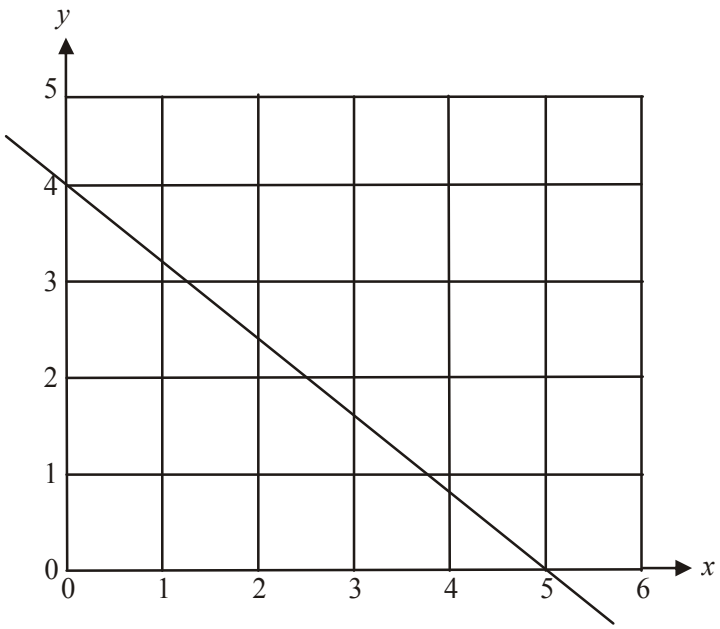
In the rectangular prism above, point J is the centre of the top face, $EFGH$, of the prism and the point K is vertically below point J.
The angle BJK is closest to

A. 30°
B. 35°
C. 45°
D. 55°
E. 71°

Module 3: Graphs and relations

If you choose this module all questions must be answered.

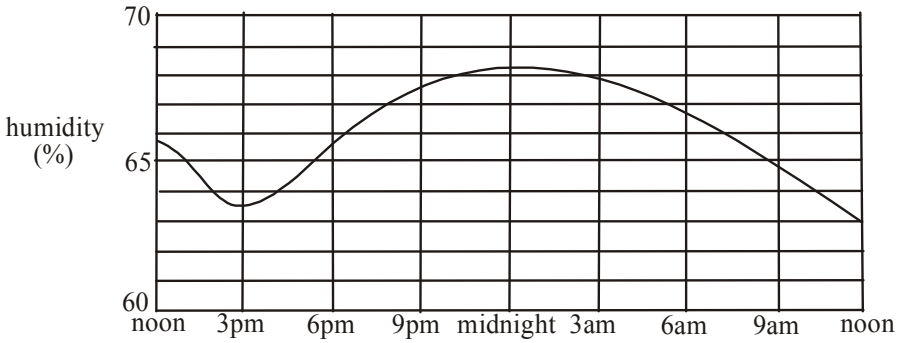
Question 1



The equation of the straight line shown is

A. $x = 5$
B. $y = 4$
C. $4x + 5y = 20$
D. $5x + 4y = 20$
E. $5x - 4y = 20$

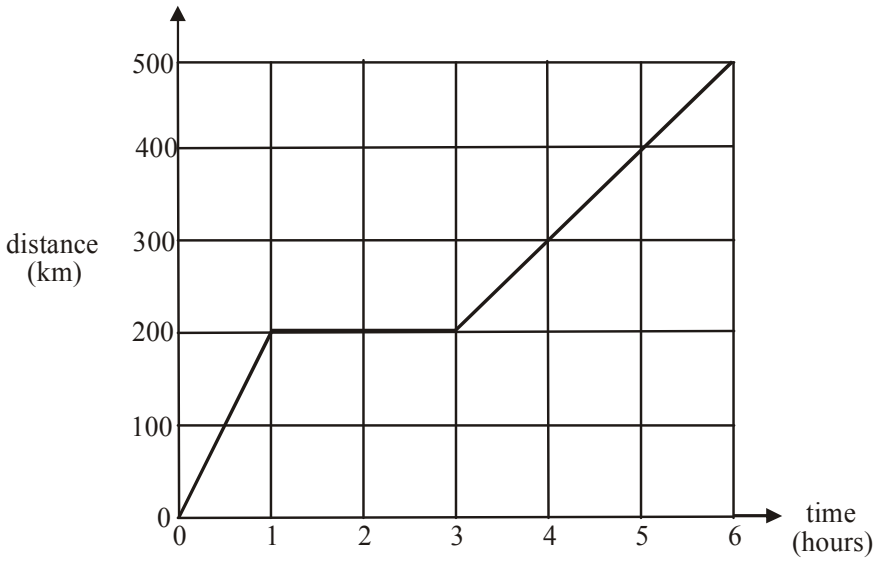
Question 2



The relative humidity at Melbourne Airport over a 24 hour period is shown above.
The relative humidity was decreasing for a total period of

A. 3 hours
B. 4 hours
C. 9 hours
D. 12 hours
E. 15 hours

The following information relates to questions 3 and 4.



The graph above shows the distance-time graph for a cargo plane.

Question 3

The cargo plane was stationary for

A. 1 hour
B. 2 hours
C. 3 hours
D. 4 hours
E. 5 hours

Question 4

Which one of the following gives the rule for the distance-time graph of the cargo plane?

A. $$d(t)=\begin{cases}200t & 0\le t<1\\ 200 & 1\le t<3\\ 100t-100 & 3\le t\le 6\end{cases}$$

B. $$d(t)=\begin{cases}200t & 0\le t<1\\ 200 & 1\le t<3\\ 100t & 3\le t\le 6\end{cases}$$

C. $$d(t)=\begin{cases}100t & 0\le t<1\\ 200 & 1\le t<3\\ 100t-100 & 3\le t\le 6\end{cases}$$

D. $$d(t)=\begin{cases}100t & 0\le t<1\\ 200 & 1\le t<3\\ 100t & 3\le t<6\end{cases}$$

E. $$d(t)=\begin{cases}\dfrac{t}{200} & 0\le t<1\\ 200 & 1\le t<3\\ 100t & 3\le t\le 6\end{cases}$$

Question 5

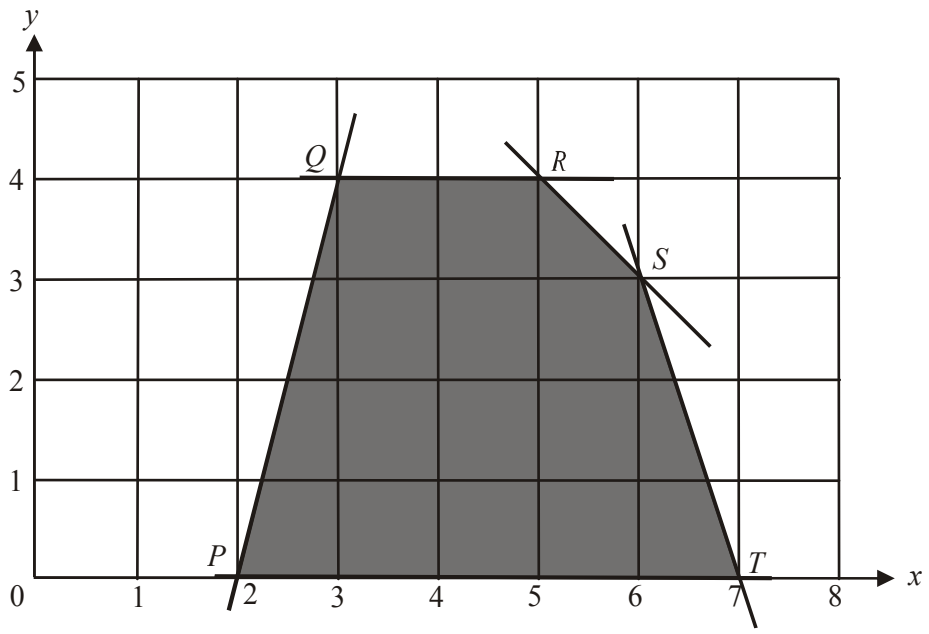
The pair of simultaneous equations

$$3x + 5y = 4$$
$$y = 5 - 2x$$

has the solution

A. $(-21,47)$
B. $(-4,3)$
C. $(-4,11)$
D. $(3,-1)$
E. $(3,11)$

Question 6



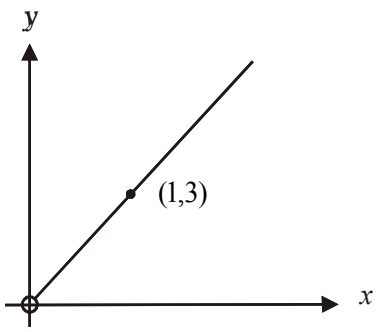
The shaded region above, which includes boundaries, is the feasible region in a linear programming problem. The corner points are indicated by *P*, *Q, R*, *S* and *T*.
The minimum value of the objective function $C = 2x - y$ occurs at

A. *P*
B. *Q*
C. *R*
D. *S*
E. *T*

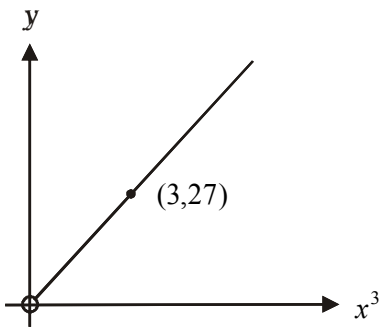
Question 7

Which one of the following represents the relation $y = 3x^3$ for $x > 0$?

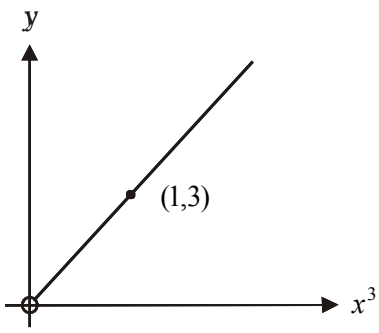
A.



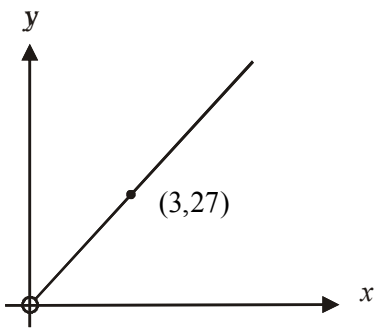
B.



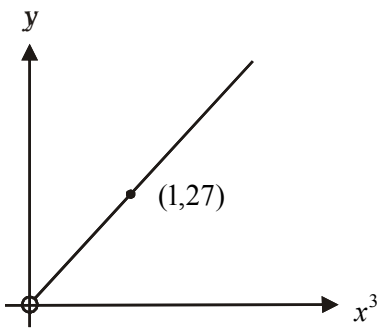
C.



D.



E.



Question 8

Junior membership at a golf club has a yearly fee of $\$x$ and a fee per game of $\$y$.
In their first year of junior membership James pays a total of $450 for membership and game fees and his mate Andrew pays $570.
Given that James plays 10 games of golf during the year and Andrew plays 22, what is the yearly junior membership fee at the golf club?

A. $120
B. $250
C. $270
D. $330
E. $350

Question 9

At a cake shop, there are 15kg of apples and 18kg of pastry available to make apple pies and apple turnovers.
Each apple pie requires 200g of apple and 120g of pastry. Each apple turnover requires 100g of apple and 150g of pastry.

Let x be the number of apple pies and y be the number of apple turnovers produced.
The two constraints related to the availability of apple and pastry are respectively given by

A.
$$100x + 150y \leq 15\,000$$
$$200x + 120y \leq 18\,000$$

B.
$$100x + 150y \leq 18\,000$$
$$200x + 150y \leq 15\,000$$

C.
$$200x + 100y \leq 15\,000$$
$$120x + 150y \leq 18\,000$$

D.
$$200x + 150y \leq 15\,000$$
$$120x + 100y \leq 18\,000$$

E.
$$200x + 150y \leq 18\,000$$
$$120x + 100y \leq 15\,000$$

Module 4: Business-related mathematics

If you choose this module all questions must be answered.

Question 1

Sam's mum invested the money from his money box in an account earning simple interest at the rate of 4% per annum. After 3 years Sam had earned $7.50 in interest.
In Sam's money box there had been

A. $17.78
B. $62.50
C. $76.50
D. $97.20
E. $160

Question 2

Julian buys a power tool for $176.50 which includes a Goods and Services Tax (GST) of 10%.
The amount of GST tax that Julian is paying on his purchase is

A. $16.05
B. $16.95
C. $17.65
D. $19.61
E. $160.45

Question 3

Suzie invests $12 000 in an account that pays 5.8% per annum interest that is compounded every 6 months.
The amount of interest that Suzie receives during the second year of her investment is

A. $726.57
B. $747.64
C. $12 348.00
D. $12 706.09
E. $13 074.57

Question 4

A commercial washing machine is depreciated at the rate of 0.08 cents for every load that it washes.
Its purchase price was $2 250.
The number of loads it will have washed by the time it's book value is $1 000 is

A. 12 500
B. 15 625
C. 28 125
D. 195 313
E. 1 562 500

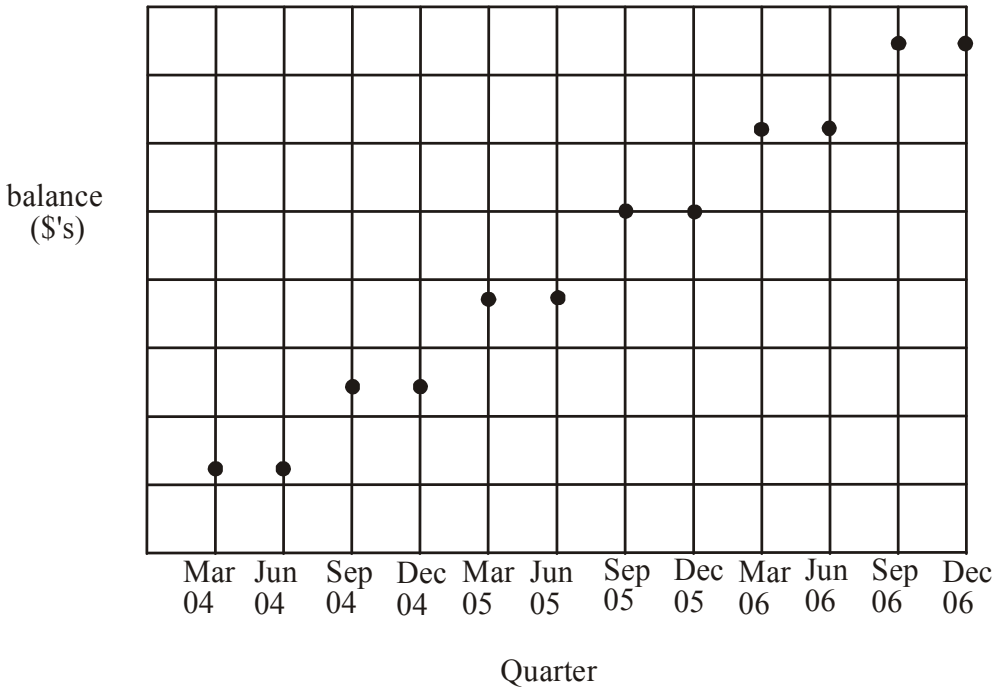
Question 5

Therese buys a clothes dryer with a purchase price of $659.
She agrees to a deposit of $159 and monthly payments of $45 for 1 year.
The effective rate of interest per annum that applies to this deal is closest to

A. 8%
B. 11.21%
C. 12.14%
D. 14.77%
E. 16%

Question 6

The graph below shows the balance of an investment account at the end of each quarter over a period of 3 years. The same rate of interest was applied to the account during the entire 3 years.



The interest that was calculated for this account was

A. simple interest calculated on the opening balance and added to the account each quarter.
B. simple interest calculated on the opening balance and added to the account each 6 months.
C. compound interest that is compounding each quarter and is added to the account each quarter.
D. compound interest that is compounding each 6 months and is added to the account each 6 months.
E. compound interest that is compounding each 6 months and is added to the account each 12 months.

Question 7

A bank statement for the months of July to December 2006 is shown below

Date	Transaction details	Credit	Debit	Balance
01Jul 06	Opening Balance			4 329.18
18Oct 06	Deposit – ATM	700.00		5 029.18
29Oct 06	Withdrawal – internet		450.00	4 579.18
15Nov 06	Withdrawal – ATM		200.00	4 379.18
03Dec 06	Payment – Melbourne Water		267.32	4 111.86
31Dec 06				

The interest on this account is calculated on the minimum monthly balance at the rate of 6% per annum. For this account, the interest for 01 July 2006 to 31 December 2006 is to be paid on 31 December 2006.
The balance after this interest payment will be

A. $4 175.96
B. $4 240.90
C. $4 242.15
D. $4 244.40
E. $4 358.57

Question 8

Ellen invests $120 000 in an annuity which earns interest calculated monthly at the rate of 6.6% per annum. Ellen has planned that the annuity payments will last for 15 years. Each month she will receive

A. $669.43
B. $689.03
C. $1 051.94
D. $3 429.63
E. $8 356.50

Question 9

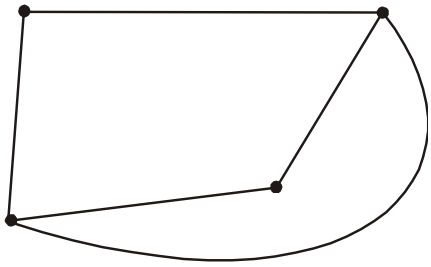
Genevieve borrows $60 000 and makes quarterly repayments of $3 634.09 paying interest at the annual rate of 7.6%.
One year after Genevieve takes out the loan, the interest rate increases to 8.6%.
If she continues to repay the same quarterly amount, the extra time it will take to repay the loan will be closest to

A. one month
B. two months
C. six months
D. twelve months
E. sixteen months

Module 5: Networks and decision mathematics

If you choose this module all questions must be answered.

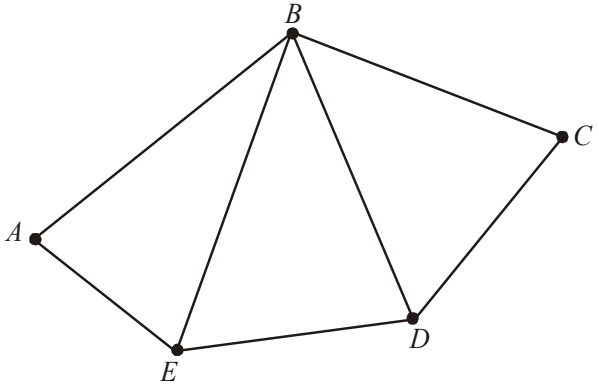
Question 1



The sum of the degrees of all the vertices in the network above is

A. 4
B. 5
C. 8
D. 10
E. 11

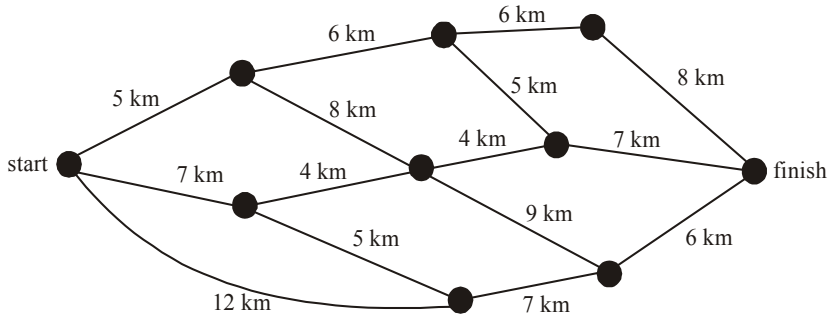
Question 2



In the network above it is possible to have an Euler path that

A. begins at *A* and finishes at *C*
B. begins at *A* and finishes at *D*
C. begins at *B* and finishes at *A*
D. begins at *D* and finishes at *A*
E. begins at *E* and finishes at *D*

Question 3



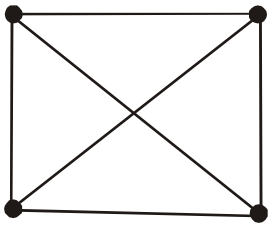
In the network above, the shortest path in km between the start and the finish is

A. 21
B. 22
C. 23
D. 24
E. 25

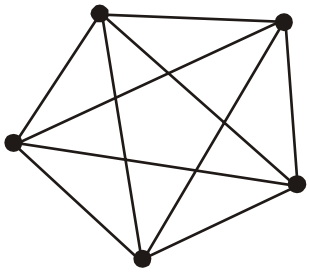
Question 4

Euler's formula; given by $v + f = e + 2$, cannot be applied to which one of the following?

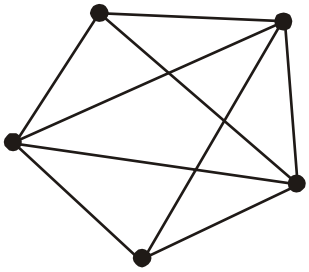
A.



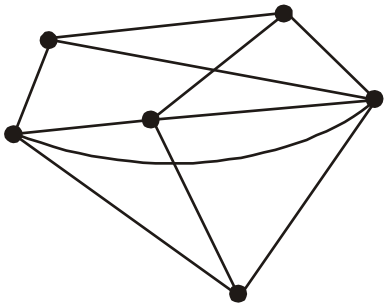
B.



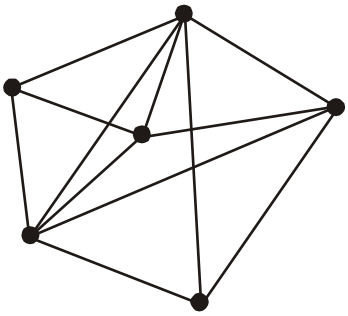
C.



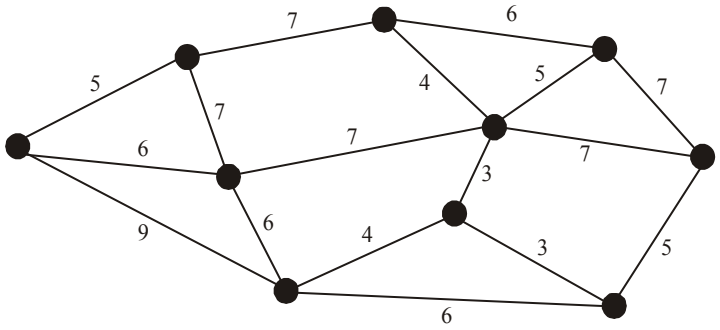
D.



E.



Question 5

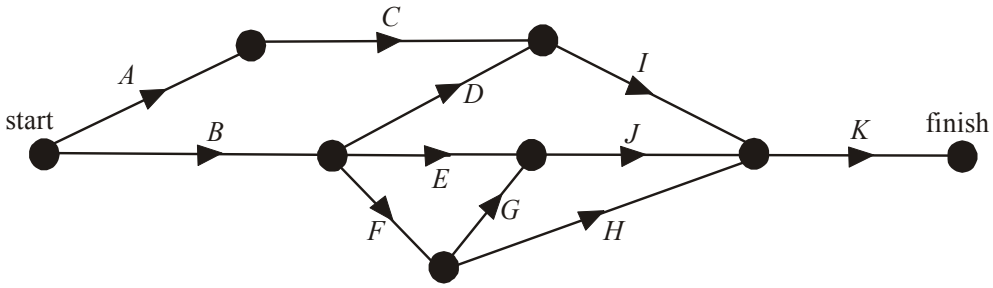


The minimum spanning tree for the network shown above has a length of

A. 36
B. 39
C. 41
D. 43
E. 47

Question 6

A project involves 11 activities that must be completed. Those activities together with their immediate predecessor (referred to as "I P" in the tables) are shown below.



The table that gives the activities and their immediate predecessors is

A.

Activity	I P
A	-
B	-
C	*A*
D	*B*
E	*B*
F	*B*
G	*F*
H	*F*
I	*C,D*
J	*E,G*
K	*I,J,H*

B.

Activity	I P
A	-
B	*A*
C	*A*
D	*B*
E	*B*
F	*B*
G	*F*
H	*F*
I	*C,D*
J	*EG*
K	*I,J,H*

C.

Activity	I P
A	-
B	-
C	*A*
D	*B,E*
E	*B*
F	*B*
G	*F,H*
H	*F,G*
I	*C,D*
J	*E*
K	*I*

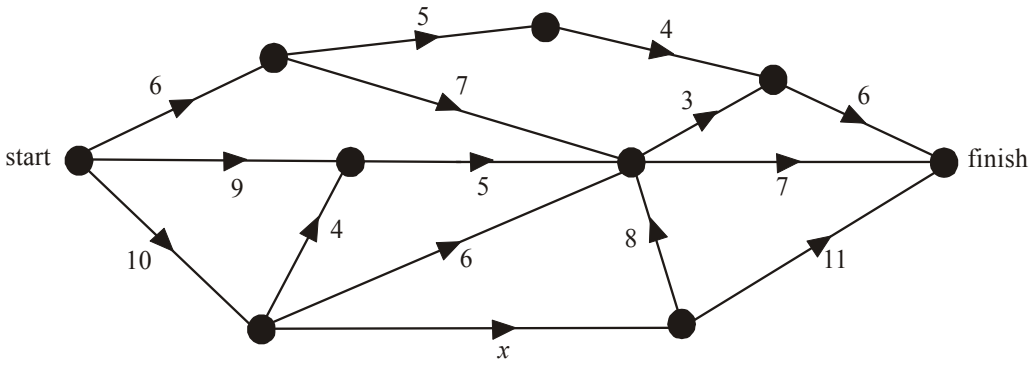
D.

Activity	I P
A	-
B	-
C	*A*
D	*B*
E	*B*
F	*B*
G	*F*
H	*F*
I	*C,D*
J	*E*
K	*J*

E.

Activity	I P
A	-
B	-
C	*A*
D	*B*
E	*B*
F	*B*
G	*F,H*
H	*F,G*
I	*C*
J	*E*
K	*J*

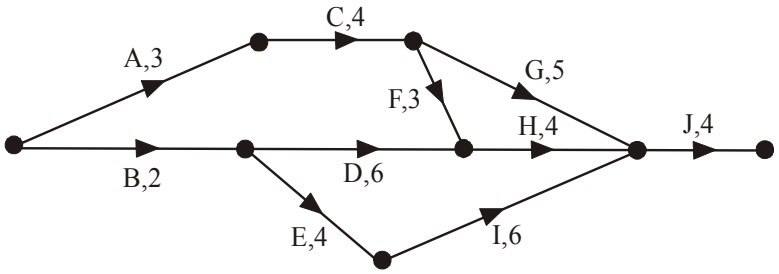
Question 7



On the directed graph above the numbers on the edges give the maximum flow possible through each of those edges.
The maximum flow possible through the network is 18.
The value of x is

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

The information below relates to Questions 8 and 9.



The network above shows a collection of activities; and the time it takes in weeks to complete them, which make up a project that is being undertaken.

Question 8

The time taken in weeks for the completion of the activities on the critical path of this project is

A. 16
B. 17
C. 18
D. 19
E. 20

Question 9

The project is to be crashed by reducing the completion time of activity A to 1 week. The number of activities that **do not** now lie on the critical path is/are

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

Module 6: Matrices

If you choose this module all questions must be answered.

Question 1

$\begin{bmatrix}3\\5\end{bmatrix} - 2\begin{bmatrix}0\\1\end{bmatrix}$ is equal to

A. $\begin{bmatrix}0\\0\end{bmatrix}$

B. $\begin{bmatrix}1\\3\end{bmatrix}$

C. $3\begin{bmatrix}1\\1\end{bmatrix}$

D. $\begin{bmatrix}3\\5\end{bmatrix}$

E. $\begin{bmatrix}3\\7\end{bmatrix}$

Question 2

$\begin{bmatrix}1 & 3\\2 & 9\end{bmatrix}\begin{bmatrix}1\\3\end{bmatrix} + \begin{bmatrix}3\\1\end{bmatrix}\begin{bmatrix}2\end{bmatrix}$ is equal to

A. $\begin{bmatrix}13\\32\end{bmatrix}$

B. $\begin{bmatrix}16\\31\end{bmatrix}$

C. $\begin{bmatrix}18\\37\end{bmatrix}$

D. $\begin{bmatrix}70\\203\end{bmatrix}$

E. $\begin{bmatrix}80\\232\end{bmatrix}$

Question 3

Let $A = \begin{bmatrix} 1 & 3 \\ 2 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$.
The matrix product that does not exist is

A. AB
B. AC
C. BA
D. BC
E. CB

Question 4

Let $A = \begin{bmatrix} 2 & 1 \\ 3 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 3 \\ 2 & -7 \end{bmatrix}$.

The matrix expression $A^4 + 2B^3$ is equal to

A. $\begin{bmatrix} 468 & -1446 \\ -866 & 3570 \end{bmatrix}$

B. $\begin{bmatrix} 901 & -2934 \\ -1858 & 6979 \end{bmatrix}$

C. $\begin{bmatrix} 239 & 481 \\ 873 & 131 \end{bmatrix}$

D. $\begin{bmatrix} 86 & 623 \\ 987 & 65 \end{bmatrix}$

E. $\begin{bmatrix} 141 & 434 \\ 861 & 498 \end{bmatrix}$

Question 5

At the State Hairdressing Awards, three salons dominated the three main awards for the last three years.
The Cuts Galore Salon (CG), the Style Maker Salon (SM) and the Here for Hair Salon (HH) won awards as indicated in the table below.

	Cutting	Upstyles	Colouring
2006	CG	SM	SM
2005	HH	CG	SM
2004	HH	HH	CG

The matrix which shows the total number of awards won by each of the three salons over the last three years is

A.

$$\begin{matrix} CG & SM & HH & \\ \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \\ 1 & 2 & 0 \end{bmatrix} & & & \begin{matrix} 2006 \\ 2005 \\ 2004 \end{matrix} \end{matrix}$$

B.

$$\begin{matrix} CG & SM & HH & \\ \begin{bmatrix} 1 & 0 & 2 \\ 1 & 1 & 1 \\ 1 & 2 & 0 \end{bmatrix} & & & \begin{matrix} 2006 \\ 2005 \\ 2004 \end{matrix} \end{matrix}$$

C.

$$\begin{matrix} CG & SM & HH & \\ \begin{bmatrix} 1 & 2 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 2 \end{bmatrix} & & & \begin{matrix} 2006 \\ 2005 \\ 2004 \end{matrix} \end{matrix}$$

D.

$$\begin{matrix} CG & SM & HH & \\ \begin{bmatrix} 1 & 0 & 2 \\ 1 & 1 & 1 \\ 1 & 0 & 2 \end{bmatrix} & & & \begin{matrix} 2006 \\ 2005 \\ 2004 \end{matrix} \end{matrix}$$

E.

$$\begin{matrix} CG & SM & HH & \\ \begin{bmatrix} 1 & 2 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 2 \end{bmatrix} & & & \begin{matrix} 2006 \\ 2005 \\ 2004 \end{matrix} \end{matrix}$$

Question 6

If matrix $M = \begin{bmatrix} 3 & 6 & 2 & 2 \\ 7 & 5 & -1 & 4 \end{bmatrix}$ and the matrix product $AM = \begin{bmatrix} 1 & 8 & 4 & 1 \end{bmatrix}$ then the order of matrix A is

A. (1×2)
B. (1×4)
C. (2×2)
D. (2×4)
E. (4×1)

Question 7

Consider the three sets of simultaneous equations

Set 1	Set 2	Set 3
$2x + y = 1$	$x - 2y = 5$	$3x + y = 5$
$x - 3y = 4$	$6y = 1$	$x = 7$

Which of these sets have a unique solution?

A. set 1 only
B. set 2 only
C. sets 1 and 2 only
D. sets 2 and 3 only
E. all of these sets

Question 8

The matrix equation $\begin{bmatrix} 3 & -4 \\ 1 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -6 \\ 8 \end{bmatrix}$ has the solution

A. $\begin{bmatrix} -2 \\ 0 \end{bmatrix}$
B. $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$
C. $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$
D. $\begin{bmatrix} 3 \\ 4 \end{bmatrix}$
E. $\begin{bmatrix} 20 \\ 30 \end{bmatrix}$

Question 9

The price, in dollars, of a washing machine and a clothes dryer at two different bulk stores *A* and *B* is given in the matrix below.

$$\begin{matrix} \text{washing} & \text{clothes} \\ \text{machine} & \text{dryer} \end{matrix}$$
$$\begin{bmatrix} 850 & 420 \\ 810 & 450 \end{bmatrix} \begin{matrix} A \\ B \end{matrix}$$

Store *A* reduces its prices by 10% and store *B* reduces its prices by 20%.
The new price matrix could be given by

A. $\begin{bmatrix} 0 \cdot 1 \\ 0 \cdot 2 \end{bmatrix} \begin{bmatrix} 850 & 420 \\ 810 & 450 \end{bmatrix}$

B. $\begin{bmatrix} 0 \cdot 1 & 0 \cdot 2 \end{bmatrix} \begin{bmatrix} 850 & 420 \\ 810 & 450 \end{bmatrix}$

C. $\begin{bmatrix} 0 \cdot 9 & 0 \\ 0.8 & 0 \end{bmatrix} \begin{bmatrix} 850 & 420 \\ 810 & 450 \end{bmatrix}$

D. $\begin{bmatrix} 0 \cdot 9 & 0 \\ 0 & 0 \cdot 8 \end{bmatrix} \begin{bmatrix} 850 & 420 \\ 810 & 450 \end{bmatrix}$

E. $\begin{bmatrix} 0 \cdot 9 & 0 \cdot 8 \\ 0 \cdot 9 & 0 \cdot 8 \end{bmatrix} \begin{bmatrix} 850 & 420 \\ 810 & 450 \end{bmatrix}$

Further Mathematics Formulas

Core: Data analysis

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

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

residual value: residual value = actual value – predicted value

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

Module 1: Number patterns

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

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

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

Module 2: Geometry and trigonometry

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

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

circumference of a circle: $2\pi r$

area of a circle: πr^2

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

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

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

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

volume of a prism: area of base $\times$ height

volume of a pyramid: $\dfrac{1}{3}$ area of base $\times$ height

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

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

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

Module 3: Graphs and relations

Straight line graphs

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

equation: $y = mx + c$

Module 4: Business-related mathematics

simple interest: $I = \frac{PrT}{100}$

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

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

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

FURTHER MATHEMATICS

TRIAL EXAMINATION 1

MULTIPLE- CHOICE ANSWER SHEET

STUDENT NAME:..

INSTRUCTIONS

Fill in the letter that corresponds to your choice. Example: A ▬ C D E

The answer selected is B. Only one answer should be selected.

Section A - Core

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

Section B - Modules

Module Number ___

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 Number ___

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
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7. A B C D E
8. A B C D E
9. A B C D E

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8. A B C D E
9. A B C D E

