Carlingford High School

Mathematics Standard 2

Year 12 Assessment Task 3 – 2019

STUDENT NUMBER:_____

General Instructions

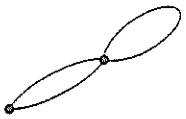
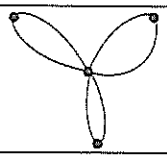
- Working time - 50 minutes
- Write using black pen, pencils may be used for diagrams
- Calculators approved by NESA may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show all relevant mathematical reasoning and/or calculations

TOPIC	MARKS	
Network concepts Questions: 1 – 3, 14 - 18	/19	
Simultaneous linear equations Questions: 4 – 6, 11 - 13	/15	
Bivariate data Questions: 7, 8 - 10	/16	
TOTAL	/50	%

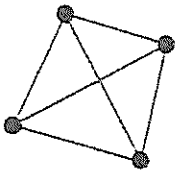
Section I
7 marks
Attempt Questions 1 - 7.

---

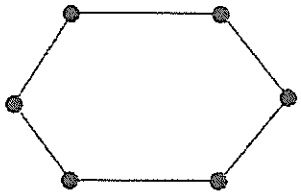
1. Which of the following graphs contains a loop?

A		B	
C		D	

2. Two graphs, labelled Graph 1 and Graph 2, are shown below.



Graph 1

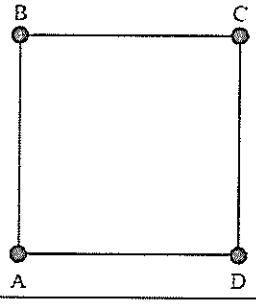


Graph 2

The sum of the degrees of the vertices of Graph 1 is:

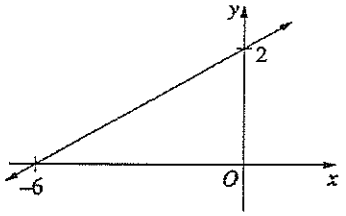
A	two less than the sum of the degrees of the vertices of Graph 2.	
B	one less than the sum of the degrees of the vertices of Graph 2.	
C	equal to the sum of the degrees of the vertices of Graph 2.	
D	one more than the sum of the degrees of the vertices of Graph 2.	

3. Which of the following walks is a cycle?



A	ABAD	
B	ABCD	
C	ABDA	
D	ABCDA	

Questions 4 and 5 refer to the following diagram.



4. What is the gradient of the line?

	A	3
	B	$-\frac{1}{3}$
	C	$\frac{1}{3}$
	D	-6

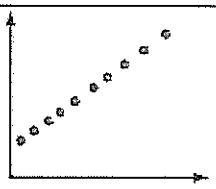
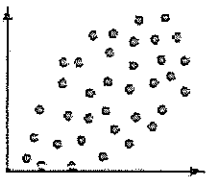
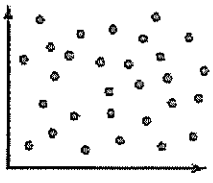
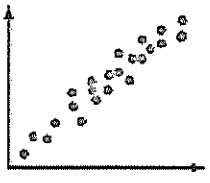
5. What is the equation of the line?

	A	$y = x + \frac{1}{3}$
	B	$y = \frac{1}{3}x + 2$
	C	$y = \frac{1}{3}x - 6$
	D	$y = 3x - 6$

6. The equation $C = 3n + 150$ models the costs for a sandwich shop. What could the 150 represent?

	A	Number of sandwiches sold
	B	The cost per sandwich
	C	Fixed daily cost
	D	Number of sandwiches made

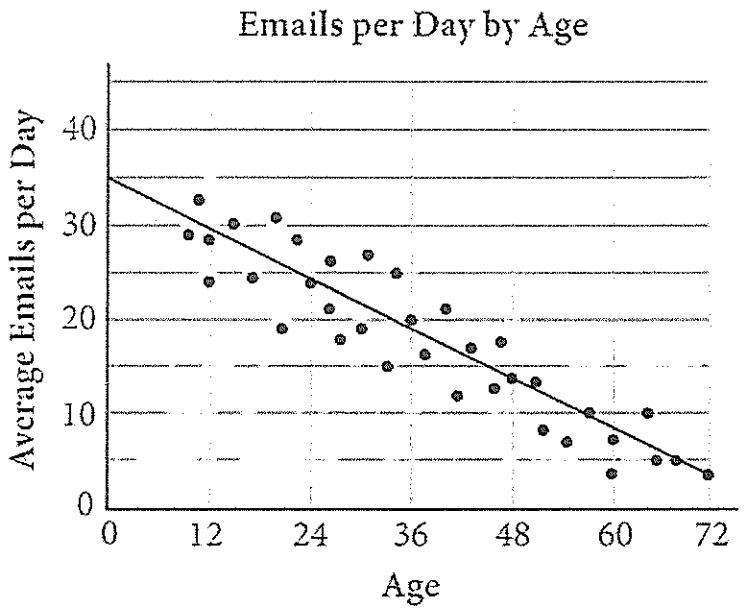
7. Which of the following graphs shows a strong positive correlation?

	A		B	
	C		D	

Section II
43 marks
Attempt Questions 8 - 19.

- Answer the questions in the spaces provided. Sufficient spaces are provided for typical responses.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

8. The number of emails received per day by 35 people is displayed below.



(a) Identify the independent variable in this situation. **1**

(b) Using the line of best fit, find the number of emails received by a person aged:

(i) 30 years old **1**

(ii) 6 years old **1**

(c) Which of the predictions from part (c) is more reliable? Why? **2**

(d) Does it make sense to interpret the vertical intercept in the context of the data? Why? **1**

9. Given the following data:

x	5	10	14	15	24	27	32	33
y	10	11	12	14	15	17	20	20

(a) Use your calculator to find the correlation coefficient of the data, correct to 2 decimal places. **1**

(b) Explain the meaning of the correlation coefficient. **2**

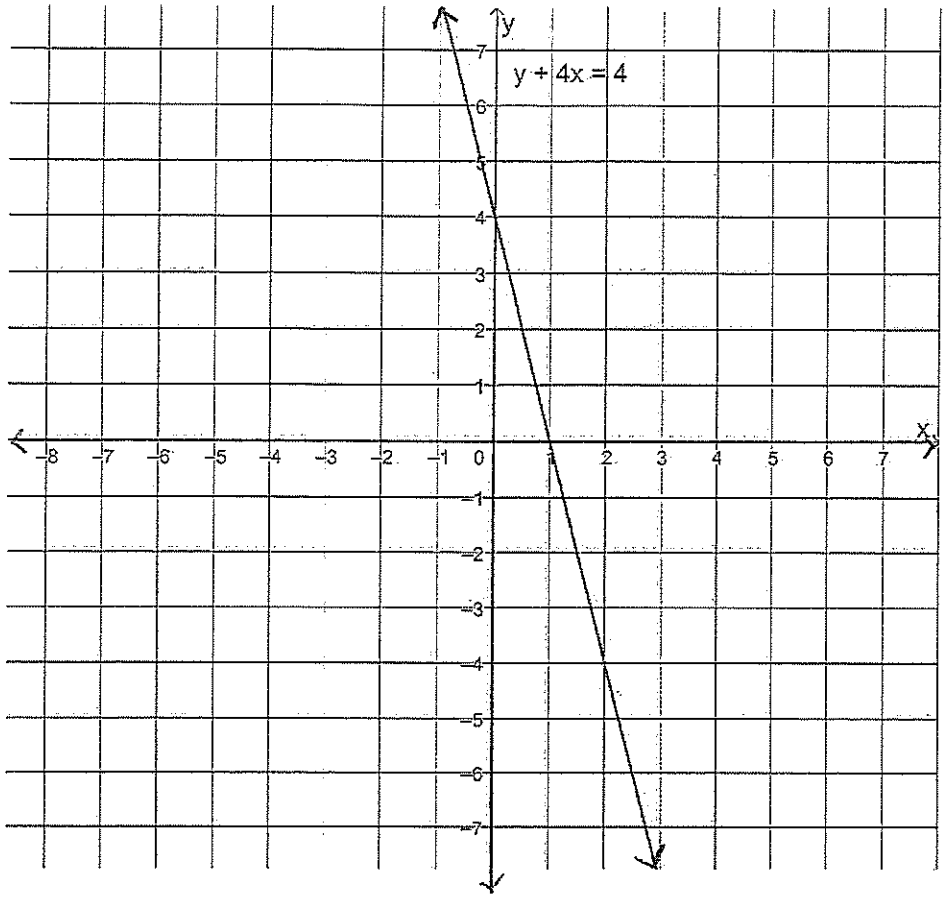
(c) Use your calculator to find the equation of the least-squares regression line for the data, correct to 2 decimal places. **2**

10. The equation of the line of best fit connecting hip measurement (H), in cm, and waist measurement (W), in cm, is $W = 0.7H - 2.1$. Use the equation to predict:

(a) the waist of a person with a hip measurement of 178cm **2**

(b) the hip measurement of a person with a waist of 60cm, correct to two decimal places. **2**

11. The graph of $y + 4x = 4$ is shown below.



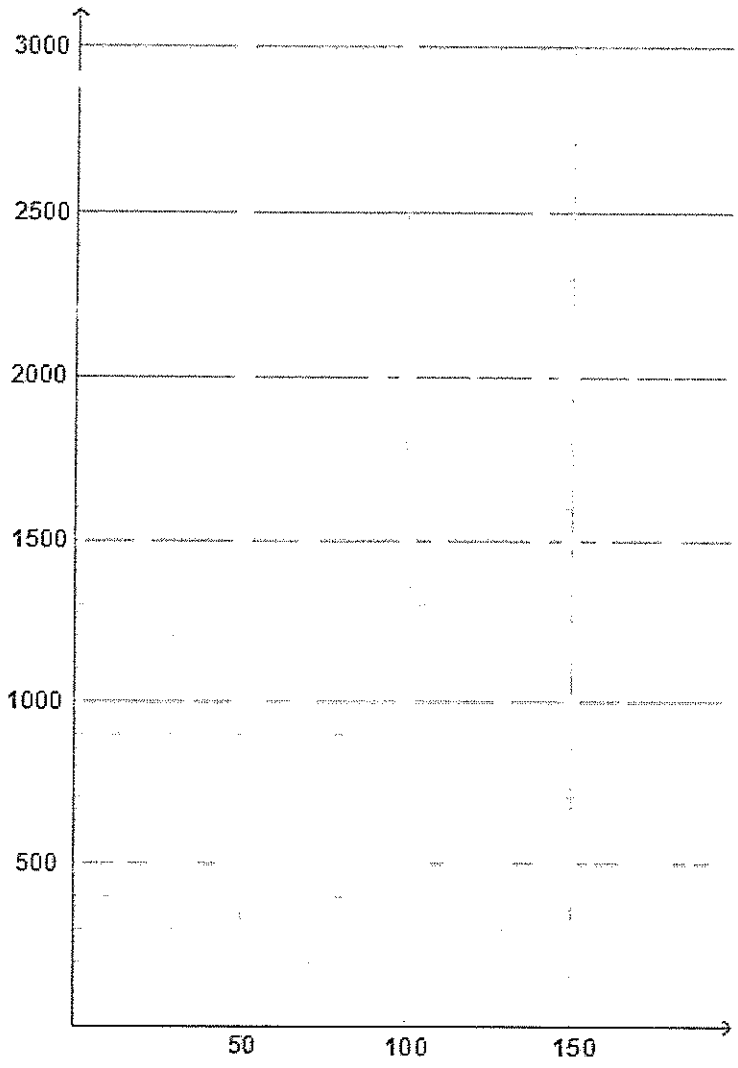
(i) Graph $y = x - 6$ on the grid provided above. **2**

(ii) What is the point of intersection of $y + 4x = 4$ and $y = x - 6$? **1**

12. A student was asked to solve the following simultaneous equations: **2**

$$y = 2x - 1 \text{ and } x - 3y + 7 = 0.$$

After graphing the equations, the student found the point of intersection to be $(2, 3)$. Is the student correct? Support your answer with calculations.

13.	Sue is planning a fund raising dance. She can hire a hall for \$400 and a band for \$600. Refreshments will cost her \$10 per person. The cost of each ticket is \$20.		
	(a)	Write an equation for the cost $\$C$ of running the dance for n people.	1
	(b)	Write an equation for the revenue $\$R$ if n people attended the dance.	1
	(c)	Graph both equations on the same set of axes below.  	2
	(d)	How many tickets must be sold to break even?	1
	(e)	How much profit will be made if 350 people attend the dance?	2

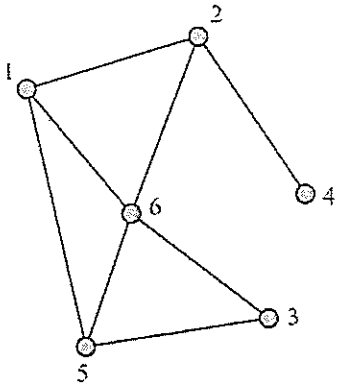
14. Here is a table of vertices A, B, C and D, and the edge weights between these vertices. **2**

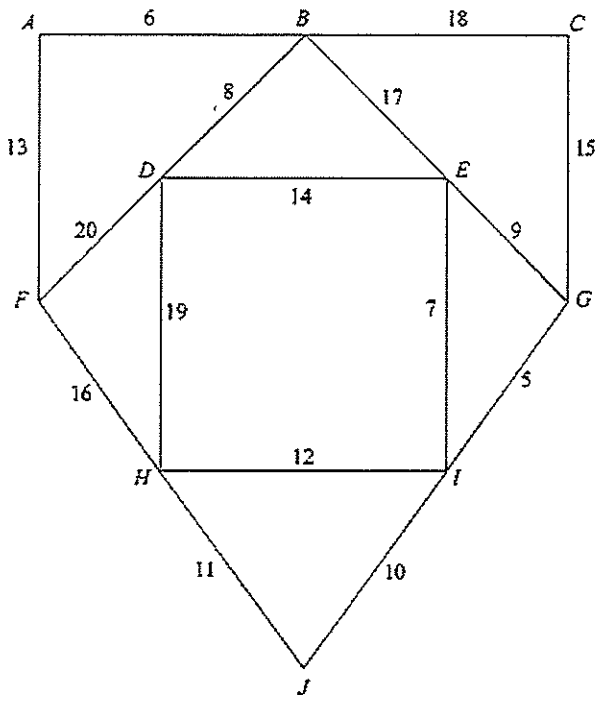
	A	B	C	D
A	-	2	4	-
B	2	-	3	-
C	4	3	-	1
D	-	-	1	-

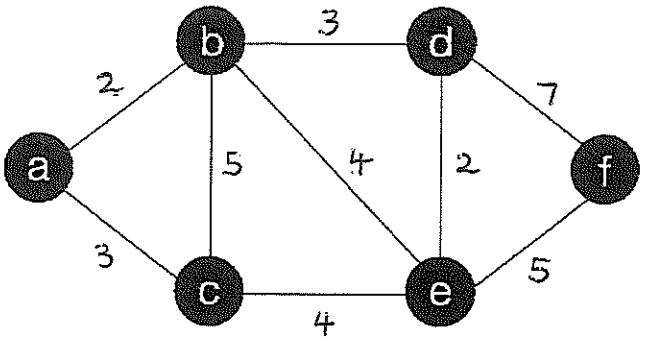
Draw a weighted network to represent this information.

15. Complete the table of vertex degrees for the network shown. **2**

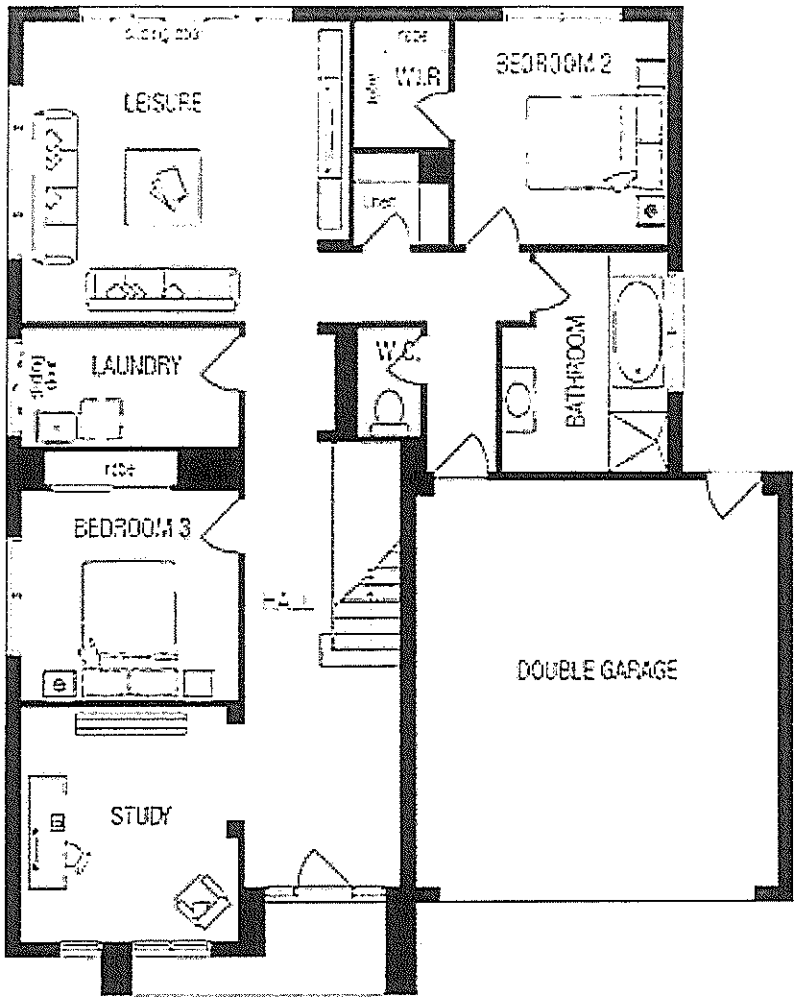
Vertex	1	2	3	4	5	6
Degree						



16.	(a)	State the number of edges in a minimum spanning tree of a network with 10 vertices.	1
	(b)	The following diagram shows a weighted network diagram.  	
		Draw the minimum spanning tree for the network above using **Kruskal's** or **Prim's** algorithm.	2
	(c)	Explain why edge EG is not included in the minimum spanning tree.	1
	(d)	What is the total weight of the minimum spanning tree?	1

17.	(i) Using Dijkstra's algorithm, draw the shortest path from vertex **a** to vertex **f** for the network diagram below.  	**2**
	(ii) Hence, what is the shortest path from vertex **a** to vertex **f**, and what is its length?	**2**

18.	The first floor plan of a house is shown below.	3



Draw a network diagram to model the possible movement inside the house. Use vertices to represent the rooms and edges to represent the doorways that connect the rooms. Make the hall be a vertex.

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Carlingford High School

Mathematics Standard 2

Year 12 Assessment Task 3 – 2019

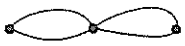
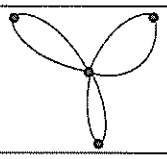
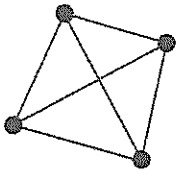
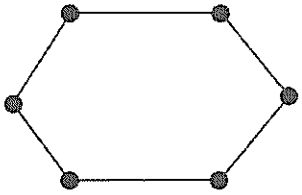
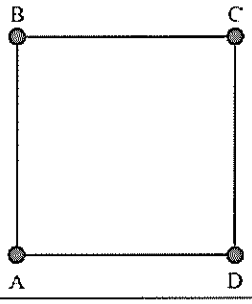
STUDENT NUMBER: Soln.

General Instructions

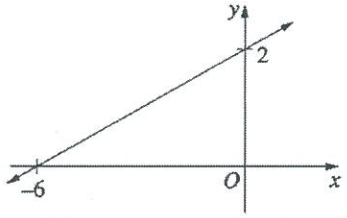
- Working time - 50 minutes
- Write using black pen, pencils may be used for diagrams
- Calculators approved by NESA may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show all relevant mathematical reasoning and/or calculations

TOPIC	MARKS	
Network concepts Questions: 1 – 3, (14 - 18) → VL	/19	
Simultaneous linear equations Questions: 4 – 6, (11 - 13) → ML	/15	
Bivariate data Questions: 7, (8 - 10) →	/16	
TOTAL	/50	%

Section I
7 marks
Attempt Questions 1 - 7.

1.	Which of the following graphs contains a loop?				
	A		B		
	C		D		
2.	Two graphs, labelled Graph 1 and Graph 2, are shown below.  Graph 1  Graph 2 The sum of the degrees of the vertices of Graph 1 is:				
	A	two less than the sum of the degrees of the vertices of Graph 2.			
	B	one less than the sum of the degrees of the vertices of Graph 2.			
	C	equal to the sum of the degrees of the vertices of Graph 2.			
	D	one more than the sum of the degrees of the vertices of Graph 2.			
3.	Which of the following walks is a cycle? 				
	A	ABAD			
	B	ABCD			
	C	ABDA			
	D	ABCDA			

Questions 4 and 5 refer to the following diagram.



4. What is the gradient of the line?

	A	3
	B	$-\frac{1}{3}$
	C	$\frac{1}{3}$
	D	-6

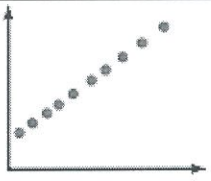
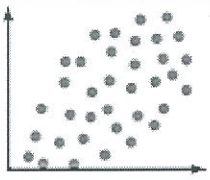
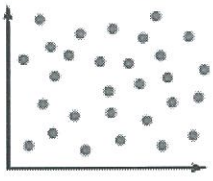
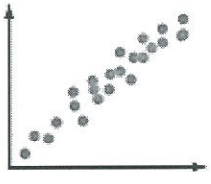
5. What is the equation of the line?

	A	$y = x + \frac{1}{3}$
	B	$y = \frac{1}{3}x + 2$
	C	$y = \frac{1}{3}x - 6$
	D	$y = 3x - 6$

6. The equation $C = 3n + 150$ models the costs for a sandwich shop. What could the 150 represent?

	A	Number of sandwiches sold
	B	The cost per sandwich
	C	Fixed daily cost
	D	Number of sandwiches made

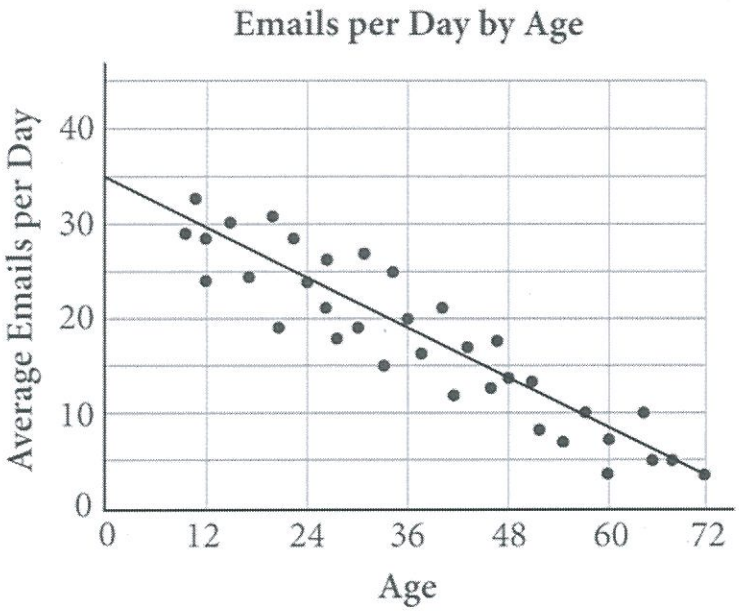
7. Which of the following graphs shows a strong positive correlation?

	A		B	
	C		D	

Section II
43 marks
Attempt Questions 8 - 19.

- Answer the questions in the spaces provided. Sufficient spaces are provided for typical responses.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

8. The number of emails received per day by 35 people is displayed below.



(a) Identify the independent variable in this situation. **1**

Age

(b) Using the line of best fit, find the number of emails received by a person aged:

(i) 30 years old **1**

22 (accept 22-23)

(ii) 6 years old **1**

32 (accept 32-33)

(c) Which of the predictions from part (c) is more reliable? Why? **2**

30 years old, as it is within the scatterplot (1)

(d) Does it make sense to interpret the vertical intercept in the context of the data? Why? **1**

No as 6 years old would not receive 35 emails per day. (must have reason).

9. Given the following data:

x	5	10	14	15	24	27	32	33
y	10	11	12	14	15	17	20	20

(a) Use your calculator to find the correlation coefficient of the data, correct to 2 decimal places. **1**

$r = 0.97858\ldots$ } accept either
$= 0.98$

(b) Explain the meaning of the correlation coefficient. **2**

(1) (1)
There is a strong positive correlation between the x and y variables

(c) Use your calculator to find the equation of the least-squares regression line for the data, correct to 2 decimal places. **2**

$y = 0.36x + 7.62$
(1) (1)

10. The equation of the line of best fit connecting hip measurement (H), in cm, and waist measurement (W), in cm, is $W = 0.7H - 2.1$. Use the equation to predict:

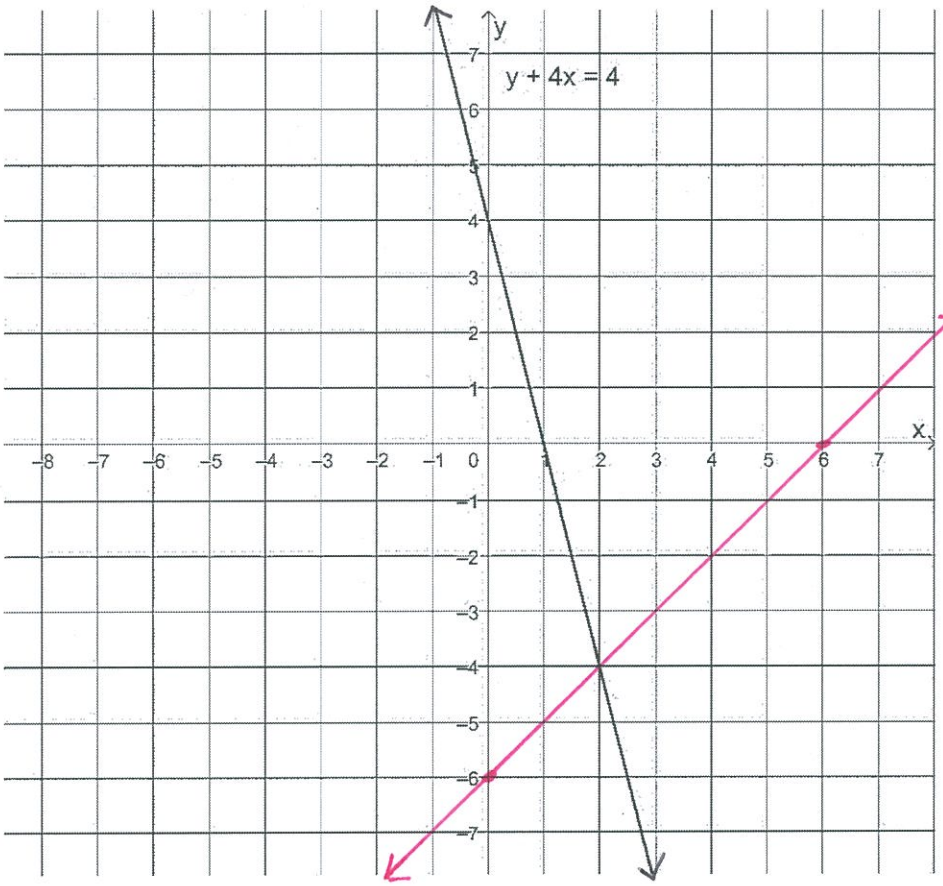
(a) the waist of a person with a hip measurement of 178cm **2**

$W = 0.7H - 2.1$
$= 0.7 \times 178 - 2.1$ (1)
$= 122.5$ (1)

(b) the hip measurement of a person with a waist of 60cm **2**

$W = 0.7H - 2.1$
$60 = 0.7H - 2.1$
(1) $62.1 = 0.7H$
$\frac{62.1}{0.7} = H$
accept any rounding
(1) $88.71 = H$

11 The graph of $y + 4x = 4$ is shown below.



(i) Graph $y = x - 6$ on the grid provided above. **2**

(ii) What is the point of intersection of $y + 4x = 4$ and $y = x - 6$? **1**

$(2, -4)$

① line
① label, arrow and use of ruler.

12 A student was asked to solve the following simultaneous equations: **2**

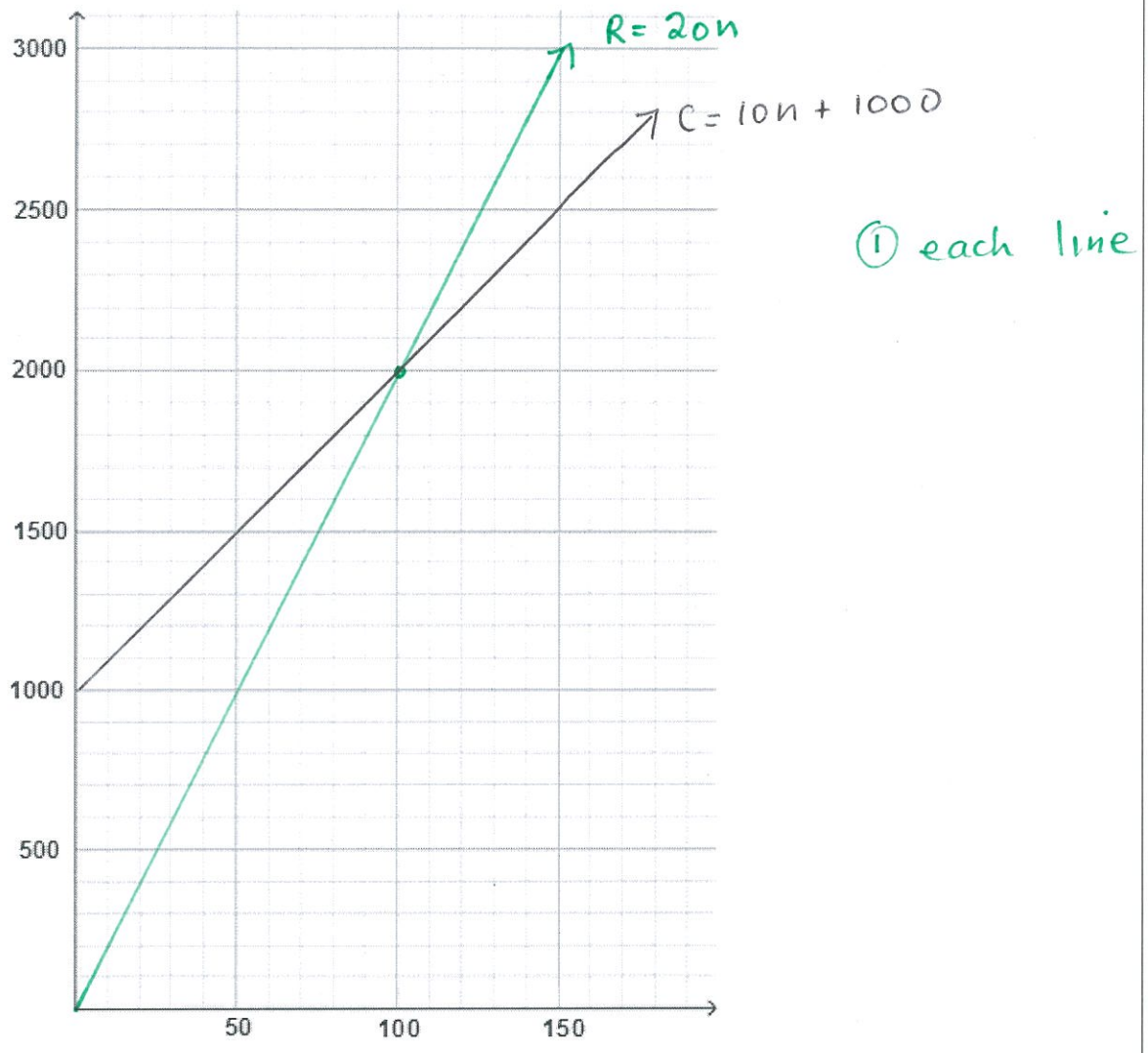
$$y = 2x - 1 \text{ and } x - 3y + 7 = 0.$$

After graphing the equations, the student found the point of intersection to be $(2, 3)$. Is the student correct? Support your answer with calculations.

① $y = 2x - 1$
$3 = 2(2) - 1$
$3 = 4 - 1$
$3 = 3$

$x - 3y + 7 = 0$
$2 - 3(3) + 7 = 0$ ①
$0 = 0$

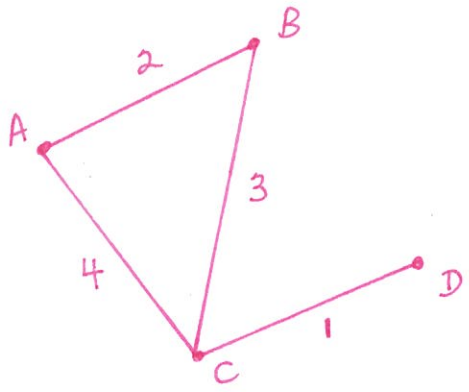
∴ student is correct as point passes through both lines.

13.	Sue is planning a fund raising dance. She can hire a hall for \$400 and a band for \$600. Refreshments will cost her \$10 per person. The cost of each ticket is \$20.		
	(a)	Write an equation for the cost $\$C$ of running the dance for n people. $C = 10n + 1000$	1
	(b)	Write an equation for the revenue $\$R$ if n people attended the dance. $R = 20n$	1
	(c)	Graph both equations on the same set of axes below.  ① each line	2
	(d)	How many tickets must be sold to break even? 100 tickets	1
	(e)	How much profit will be made if 350 people attend the dance? $R = 20 \times 350$ $= 7000$ $C = 10(350) + 1000$ $= 4500$ ① either R or C only $\therefore$ profit $= 7000 - 4500$ $= \$2500$ ①	2

14 Here is a table of vertices A, B, C and D, and the edge weights between these vertices. **2**

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

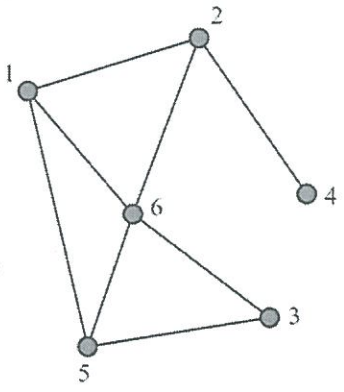
Draw a weighted network to represent this information.



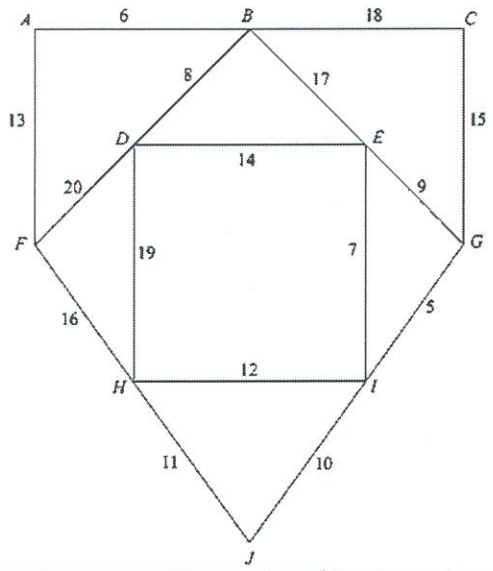
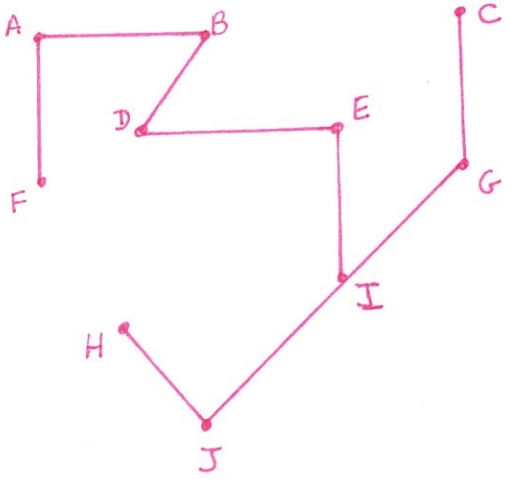
-1 each mistake

15 Complete the table of vertex degrees for the network shown. **2**

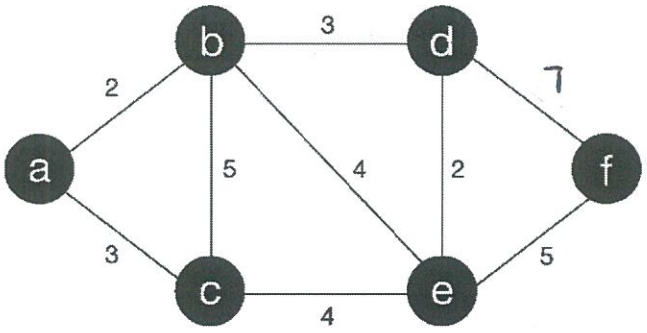
Vertex	1	2	3	4	5	6
Degree	3	3	2	1	3	4

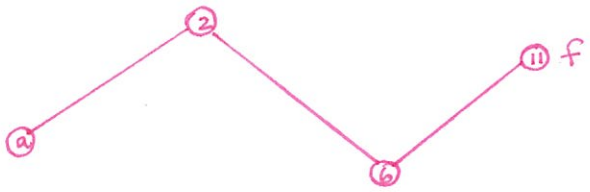


-1 each mistake

16	(a)	State the number of edges in a minimum spanning tree of a network with 10 vertices. 9	1
	(b)	The following diagram shows a weighted network diagram.  	
		Draw the minimum spanning tree for the network above using **Kruskal's** or **Prim's** algorithm.  	2
	(c)	Explain why edge EG is not included in the minimum spanning tree. It will form a cycle	1
	(d)	What is the total weight of the minimum spanning tree? 5 + 6 + 7 + 8 + 10 + 11 + 13 + 14 + 15 = 89	1

17. (i) Using Dijkstra's algorithm, draw the shortest path from vertex **a** to vertex **f** for the network diagram below. **2**



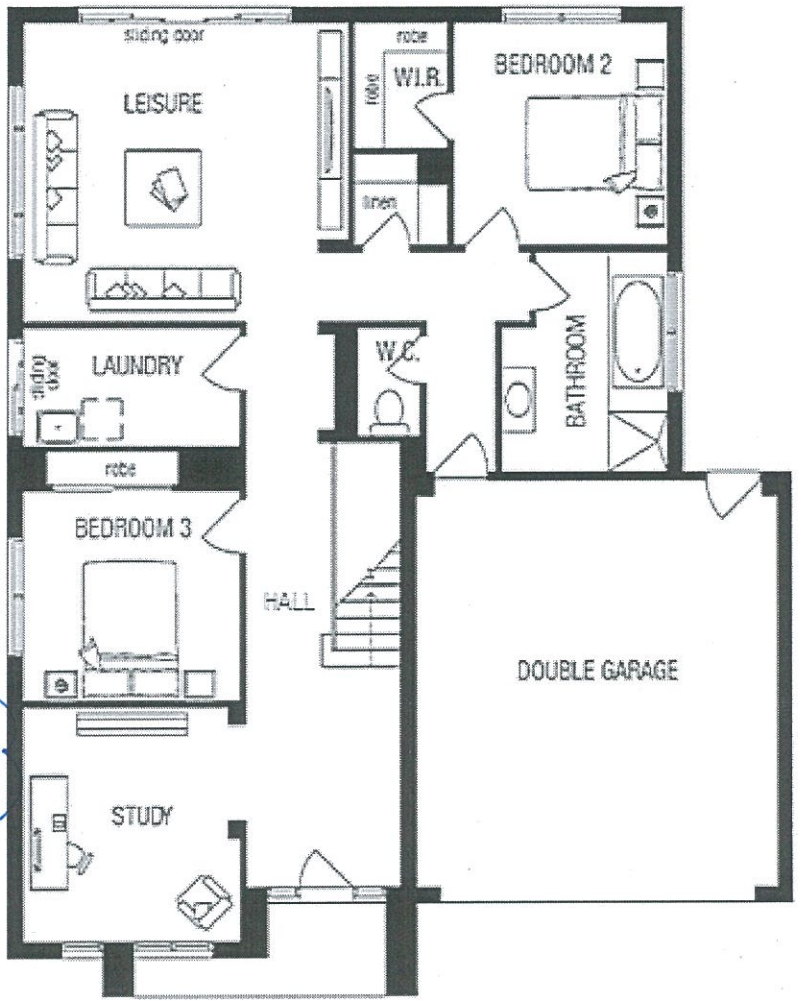


(ii) Hence, what is the shortest path from vertex **a** to vertex **f**, and what is its length? **2**

(1) abef = 2 + 4 + 5

= 11 (1)

18. The first floor plan of a house is shown below. **3**

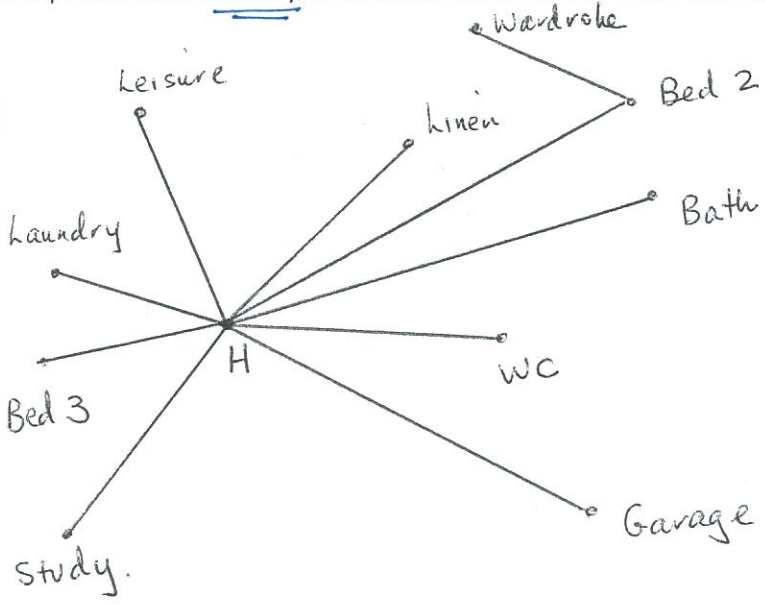


doorway
entrance into a room.
"NOT a door"

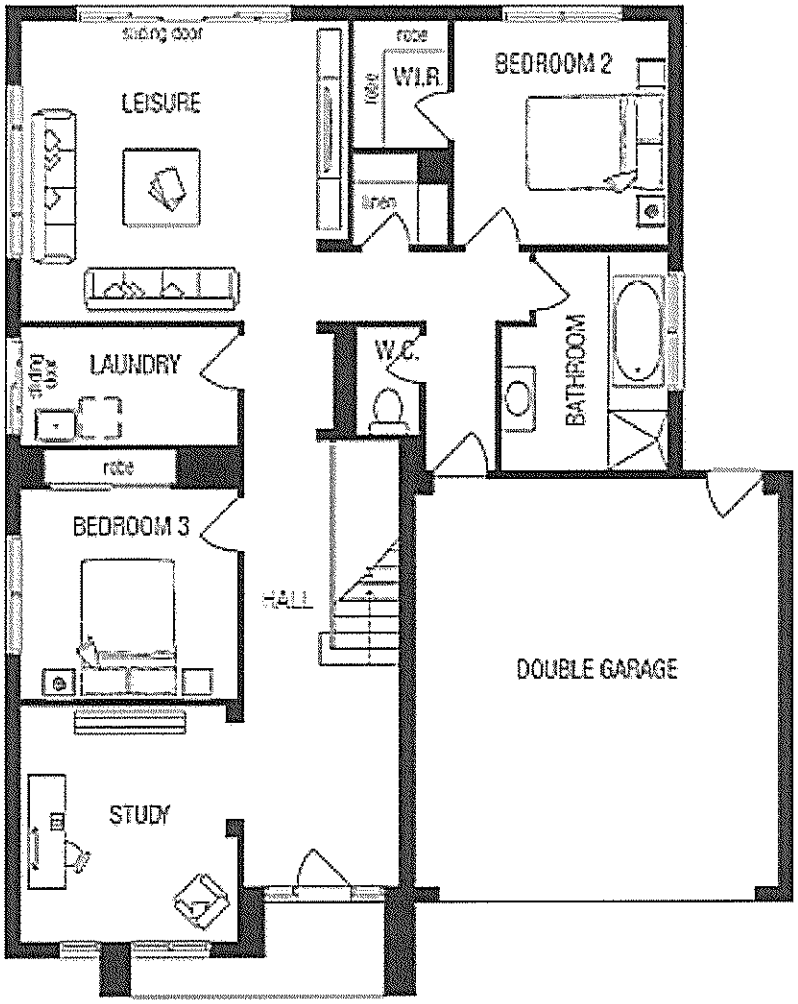
Draw a network diagram to model the possible movement inside the house. Use vertices to represent the rooms and edges to represent the doorways that connect the rooms. Make the hall be a vertex.

A "study" is a room in a house that is used for..

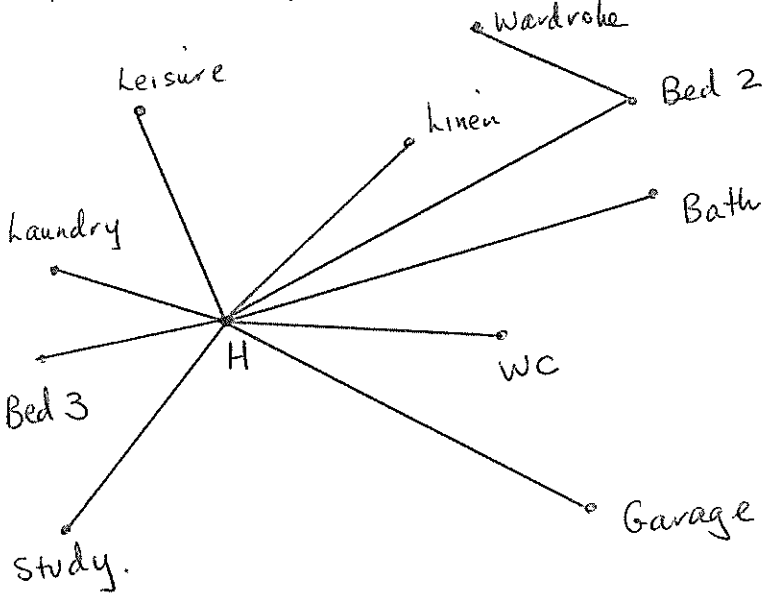
A "leisure" is a room in a house used for relaxation etc.



18.	The first floor plan of a house is shown below.	3



Draw a network diagram to model the possible movement inside the house. Use vertices to represent the rooms and edges to represent the doorways that connect the rooms. Make the hall be a vertex.



Section II extra writing space

If you use this space, clearly indicate which question you are answering.