



Barker
College

--	--	--	--	--	--	--	--

Student Number

2025

**TRIAL HIGHER SCHOOL
CERTIFICATE EXAMINATION**

Mathematics Standard 2

Staff Involved:

AM MONDAY 11TH AUGUST

- DZP - D. Peattie
- PCB - P. Boyages
- RAS - R. Smith
- DXC - D. Chua
- EJK - E. Koorey
- ARM - A. Mallam
- GPF - G. Fitzmaurice
- DZB* - D. Batchen

170 copies

Topics Covered

Investments, Depreciation and Loans	Non-right-angled Trigonometry	Rates and Ratios
Simultaneous Linear Equations	Bivariate Data Analysis	Network Concepts
Non-linear Relationships	Critical Path Analysis	Annuities

General

Instructions:

- Write your Student Number at the top of this page and all answer pages.
- Reading time - 10 minutes
- Working time - 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A separate reference sheet is provided
- Marks may not be awarded for careless or poorly arranged working
- Diagrams are not to scale
- For questions in Section II, show relevant mathematical reasoning and / or calculations

Total marks:

100

Section I - 15 marks (pages 2 - 6)

- Attempt Questions 1 - 15
- Allow about 25 minutes for this section

Section II - 85 marks (pages 7 - 22)

- Attempt Questions 16 - 43
- Allow about 2 hours and 5 minutes for this section

Section I

15 marks

Attempt Questions 1 – 15

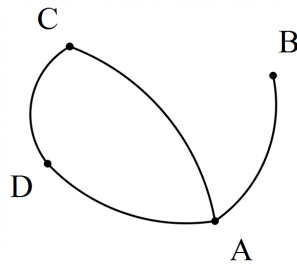
Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 15.

- 1 If $a = 2.3$ and $b = -1.5$, what does $ab^2 - 3b$ equal, correct to 3 significant figures?

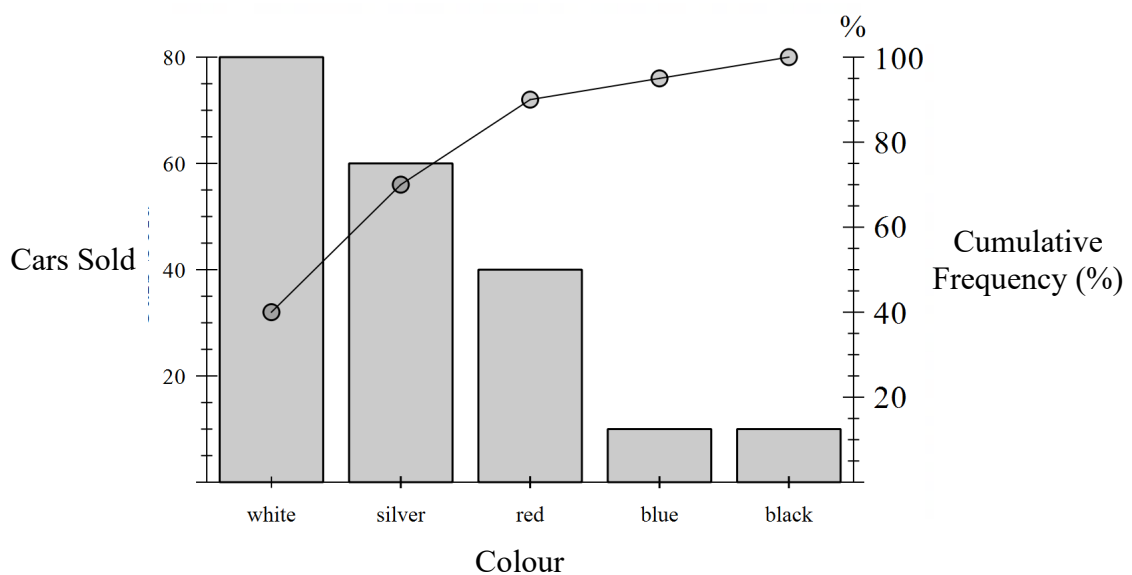
A. -0.675
B. 0.675
C. 9.67
D. 9.68

- 2 On the below network diagram, which vertex has a degree of 3?



- A. A
B. B
C. C
D. D
- 3 A new television was bought for \$3520 including 10% GST. What was the pre-GST price?
- A. \$352
B. \$3200
C. \$3872
D. \$35200
- 4 Which of the following information would be classified as numerical continuous data?
- A. The genre of a book in a library.
B. The position of a book in a line of books on a shelf in the library.
C. The mass of a book in a library.
D. The number of pages in a book in the library.

- 5 A new smart phone loses \$150 of value every year based on the straight-line method of depreciation. What was the original purchase price if it was worth \$800 after 3 years?
- A. \$350
B. \$450
C. \$1250
D. \$2400
- 6 What rate of simple interest would be needed to grow an initial investment of \$500 into \$580 after 5 years?
- A. 3.0% p.a.
B. 3.2% p.a.
C. 16.0% p.a.
D. 23.2% p.a.
- 7 A car dealership recorded the colour of the cars sold in the last year. This data is displayed in the Pareto chart below.



What percentage of cars sold were red?

- A. 20%
B. 30%
C. 40%
D. 50%

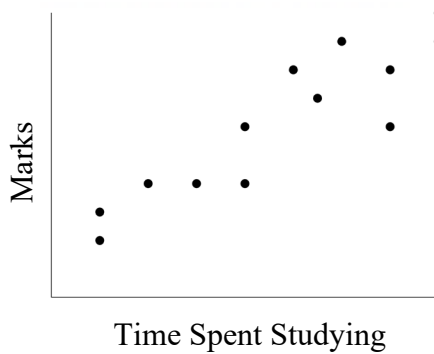
8 The true bearing of A from B is 165° . What is the true bearing of B from A?

- A. 15°
- B. 165°
- C. 195°
- D. 345°

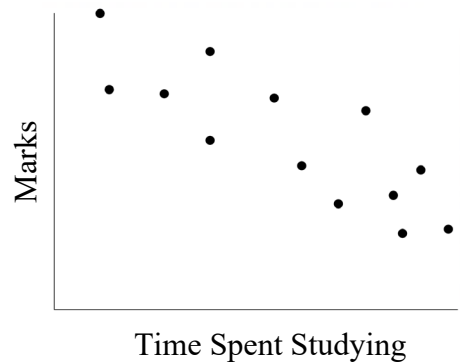
9 The amount of time spent studying for a Mathematics examination was recorded for a number of students, as well as the marks scored by each student in the examination. A scatterplot was then made of the recorded data.

Which of the following scatter plots is most likely to reflect this data?

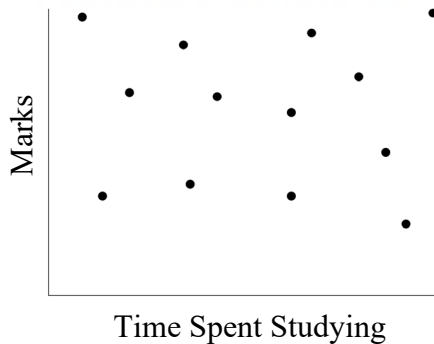
A.



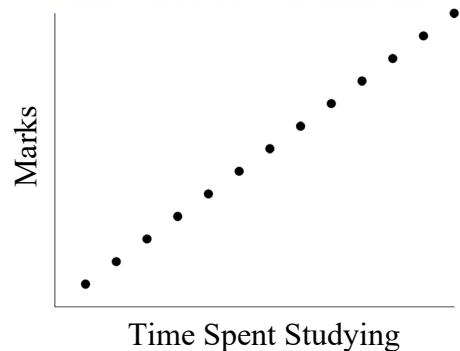
B.



C.



D.



10 An 800 watt toaster takes 3 minutes to toast 2 slices of bread at a time. What would be the total energy expenditure required to toast 100 slices of bread?

- A. 2 kWh
- B. 4 kWh
- C. 120 kWh
- D. 240 kWh

- 11 Consider the formula $h = \frac{1+dt}{d}$.

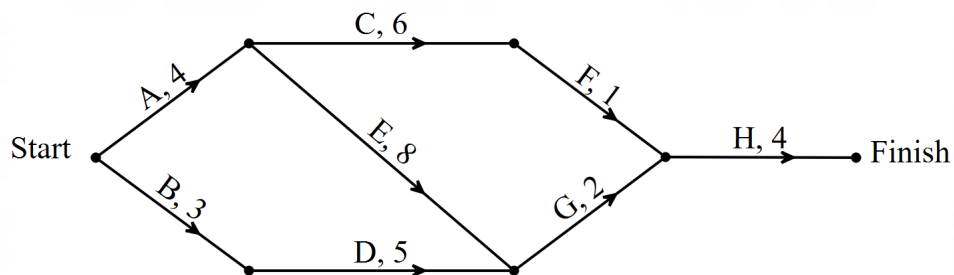
Which of the following correctly shows t as the subject of the formula?

- A. $t = \frac{1+hd}{d}$
B. $t = h-1$
C. $t = \frac{1-dh}{d}$
D. $t = \frac{dh-1}{d}$

- 12 Erica lives in Sydney (UTC +10) wanted to call her friend living in Vancouver (UTC -7). She decided to call her friend first thing after waking up in the morning. Erica went to sleep at 10:30pm on Tuesday and slept for 8 and a half hours before calling. What time and day was it in Vancouver when her friend answered?

- A. 10:00 am Tuesday
B. 2:00 pm Tuesday
C. 4:00 am Wednesday
D. 10:00 am Wednesday

- 13 The network below gives the completion time (in hours) of each activity in a project.



What is the Earliest Start Time, in hours, of activity H?

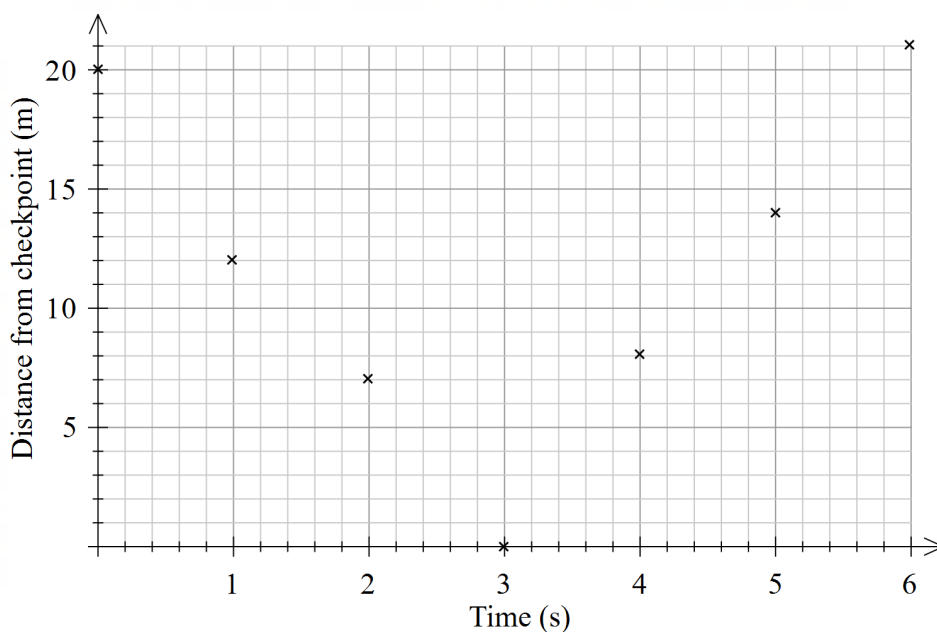
- A. 10
B. 11
C. 14
D. 18

- 14 The below table shows the present value of an annuity with a contribution of \$1.

Present Value of Annuity of \$1				
Period	1%	2%	4%	6%
1	0.9901	0.9804	0.9615	0.9434
2	1.9704	1.9416	1.8861	1.8334
3	2.9410	2.8839	2.7751	2.6730
4	3.9020	3.8077	3.6299	3.4651

What regular quarterly payment into an annuity for a year at 4% p.a. compounding quarterly would give the same as a one off lump sum payment of \$6000 with the same interest conditions?

- A. \$1500.00
 B. \$1537.67
 C. \$1652.94
 D. \$5769.00
- 15 The below graph shows the distance a runner is from a checkpoint as they run past it.



What is the runner's top speed as averaged over a 2 second period?

- A. 7.0 km/h
 B. 7.5 km/h
 C. 25.2 km/h
 D. 27.0 km/h

End of Section I

--	--	--	--	--	--	--	--

Student Number



Barker
College

Mathematics Standard 2

Section II Answer Booklet

85 marks

Attempt Questions 16 - 43

Allow about 2 hours and 5 minutes for this section

Instructions:

- Write your Student Number at the top of this page and all answer pages.
 - Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
 - Your responses should include relevant mathematical reasoning and/or calculations.
 - Extra writing paper is available.
-

Question 16 (2 marks)

Matthew earns \$40/h, and is paid time-and-a-half for each hour worked over 38 hours in a week. Calculate how much Matthew earns in a week where he works 45 hours.

.....

.....

.....

.....

Question 17 (2 marks)

The Blue Mountains Bird Watching Society recorded bird sightings at a community event. The frequency of different species being sighted were recorded in the table below.

Bird Species	Sighted Frequency
Sulphur-crested Cockatoo	13
Laughing Kookaburra	20
Crimson Rosella	12
Australian King Parrot	10
Grey Butcher Bird	5

Based on the frequencies above, how many Laughing Kookaburras would be expected to be sighted if a total of 45 birds were sighted at the next bird watching event?

.....

.....

.....

Question 18 (2 marks)

A car that was bought for \$32 000 depreciates in value by 15% per year using the declining-balance method.

Calculate the value the car has lost after 6 years, to the nearest cent.

.....

.....

.....

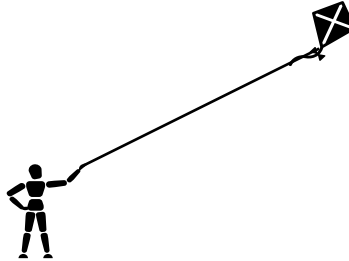
.....

--	--	--	--	--	--	--	--

Student Number

Question 19 (2 marks)

A man is flying a kite with a 10 m kite string and the kite is 6 m vertically above his hand.



Calculate the angle of elevation of the kite from the man's hand, to the nearest minute.

.....

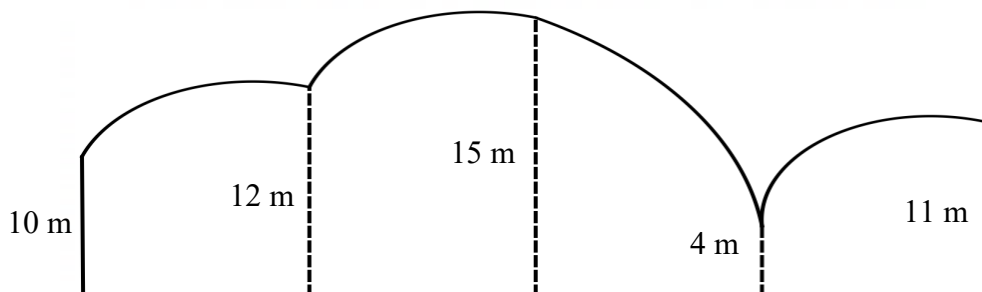
.....

.....

.....

Question 20 (3 marks)

A 200 m long section of a rock cut next to a highway was measured for height at regular intervals, as shown in the diagram below.



Using 4 applications of the trapezoidal rule, estimate the area of rock cut.

.....

.....

.....

.....

.....

.....

Question 21 (2 marks)

A biologist surveying a kangaroo population captured and tagged 60 kangaroos.
 A month later 40 kangaroos were captured and 15 had tags.
 Estimate the population of kangaroos in the area.

.....

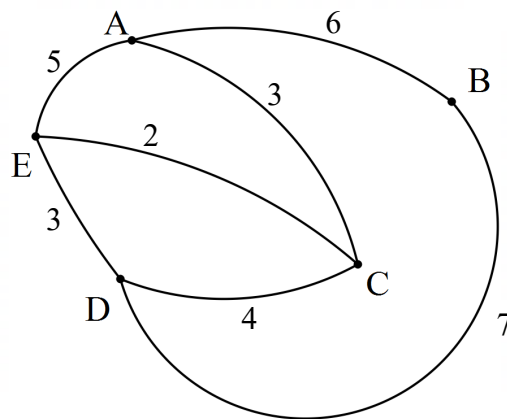
.....

.....

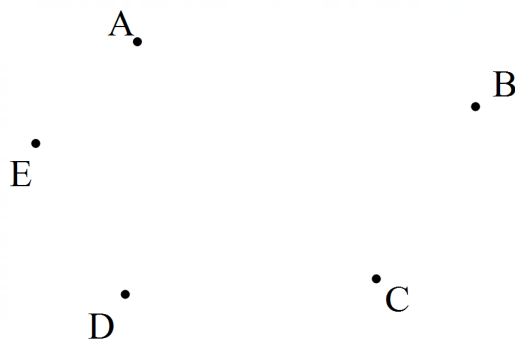
.....

Question 22 (2 marks)

A network showing the travel time (in minutes) between 5 locations is shown below.



- (i) Draw a minimum spanning tree of the above network using the vertices below. 1



- (ii) Starting from one of the locations, calculate the minimum time required to travel to all locations on the network. 1

.....

.....

--	--	--	--	--	--	--	--

Student Number

Question 23 (2 marks)

The Waitara Club first division football team has a 40% chance to win, 30% chance to draw and 30% to lose each game.

Calculate the probability that the team wins exactly 1 out of their next 2 games.

.....

.....

.....

.....

.....

.....

.....

Question 24 (3 marks)

Alyssa is driving at 80 km/h. She notices an animal on the road ahead and applies the brakes. Her reaction time is 2 seconds. Her braking distance (in metres) is given by the formula $D = 0.01v^2$, where v is speed in km/h.

Calculate her total stopping distance, to the nearest metre.

.....

.....

.....

.....

.....

.....

.....

Question 25 (4 marks)

A population of frogs can be modelled by the equation $P = a(1.22)^t$, where P is number of frogs and t is the number of years after the start the year 2025.

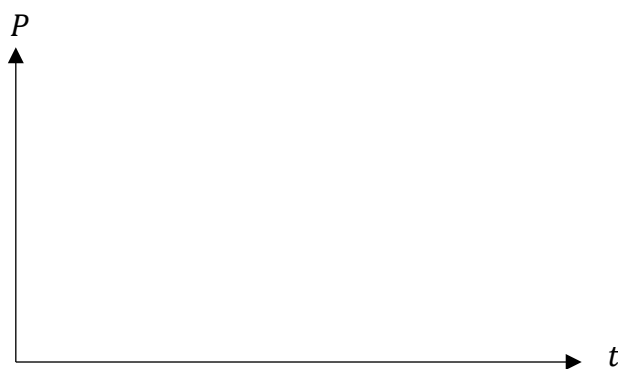
- (i) If the population at the start of 2026 was 244, show that $a = 200$. **1**

.....
.....

- (ii) What will the population be at the start of 2031, to the nearest frog? **1**

.....
.....

- (iii) On the axes below, draw the graph of the population against time, showing the point at $t = 0$ and one other point. **2**



Question 26 (3 marks)

Young's formula below is used to calculate the medication dosage over a 24-hour period for a child aged 1-12 years.

$$\text{Dosage} = \frac{\text{age of child (in years)} \times \text{adult dosage}}{\text{age of child (in years)} + 12}$$

If an 8-year-old child received a 32 mL dose over a 24 hour period, determine what adult dosage would be administered every 6 hours.

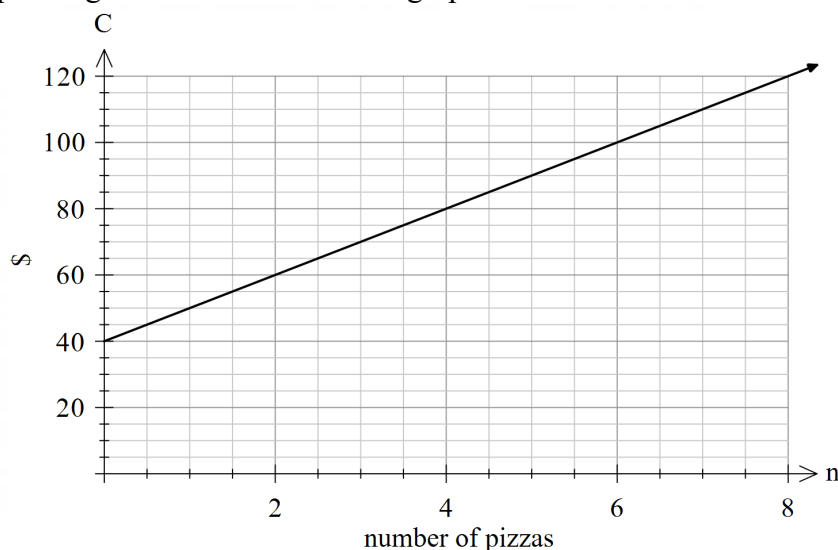
.....
.....
.....
.....
.....

--	--	--	--	--	--	--	--

Student Number

Question 27 (3 marks)

A pizza shop's operating costs are shown on the graph below.



(i) Pizzas are sold for \$20 each. On the axis above, show the revenue graph. 1

(ii) Hence, or otherwise, determine the number of pizzas needing to be sold to break even. 1

.....

(iii) Calculate the profit gained by selling 6 pizzas. 1

.....

.....

Question 28 (2 marks)

The table below shows the future value of an annuity of \$1.

<i>Rate</i> <i>Period</i>	1.5%	3%	4.5%	6%
5	5.152	5.309	5.471	5.637
10	10.703	11.464	12.288	13.181
20	23.124	26.870	31.371	36.786
40	54.268	75.401	107.030	154.762

Calculate the future value of the annuity if six-monthly contributions of \$120 are made at 6% p.a. compounding six-monthly for 10 years.

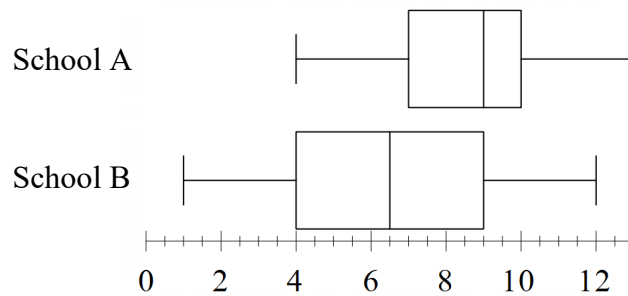
.....

.....

.....

Question 29 (6 marks)

Two groups of students from different schools were surveyed about how many books they had read that year. The results were recorded in the box plots below.



- (i) Which school is the most consistent in the amount of books read by each student? 2
Justify with the use of **two** different statistics from each school.

.....

.....

.....

- (ii) It is known that at each school, 200 students had read 9 or more books that year. 2
Calculate how many students were surveyed in total from both schools.

.....

.....

.....

.....

- (iii) A new student who had read 15 books was deciding which school to attend. 2
In which school would the number of books she had read be considered an outlier?

.....

.....

.....

.....

.....

--	--	--	--	--	--	--	--

Student Number

Question 30 (3 marks)

Jack completed a stratified sample of 20% of the students at his school.

Year Group	7	8	9	10	11	12
Number of Students Surveyed	15	16	18	20	18	x

- (i) If there are 535 students in total at the school, calculate how many year 12 students Jack surveyed. 2

.....

.....

- (ii) Give one reason why Jack may have chosen a stratified sample rather than sampling random students as they passed at the school canteen. 1

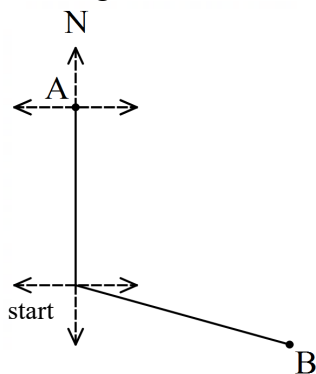
.....

.....

Question 31 (3 marks)

Alice and Barbara were out walking but wanted to visit different places. They started together, then Barbara travelled 10 km at a bearing of 120°T , while Alice travelled due north until the bearing of Barbara from Alice was 160°T .

- (i) Show the above information on the diagram below. 1



- (ii) Calculate the final distance between Alice and Barbara, to the nearest kilometre. 2

.....

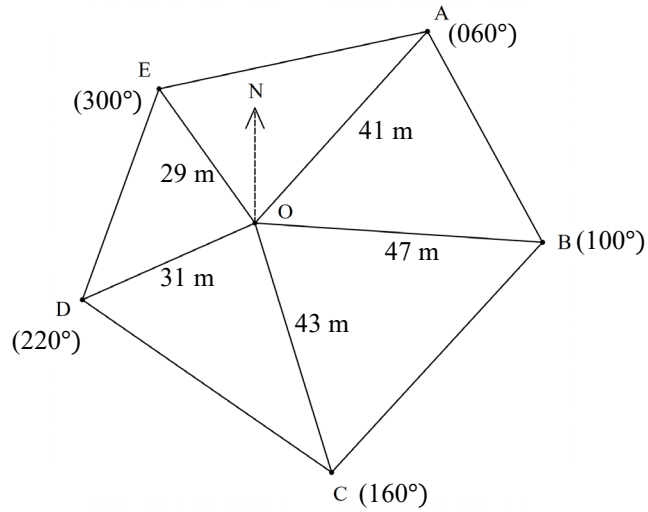
.....

.....

.....

Question 32 (3 marks)

The below diagram shows a radial survey for a recent field study.



Calculate the perimeter of triangle AEO , to the nearest metre.

.....

.....

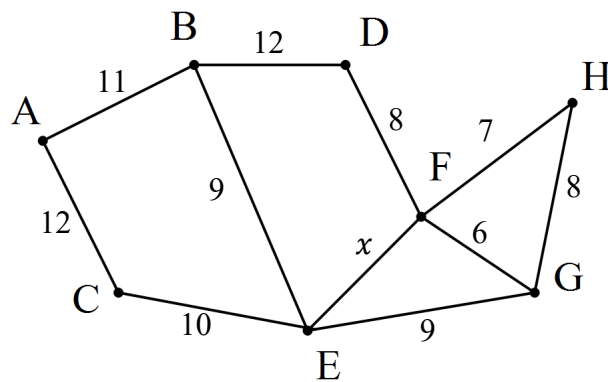
.....

.....

.....

Question 33 (2 marks)

The below network shows travel times (in minutes) between 8 different locations.



If there is **only one** shortest path from A to H , and x is on that path, calculate the largest possible whole number value of x .

.....

.....

.....

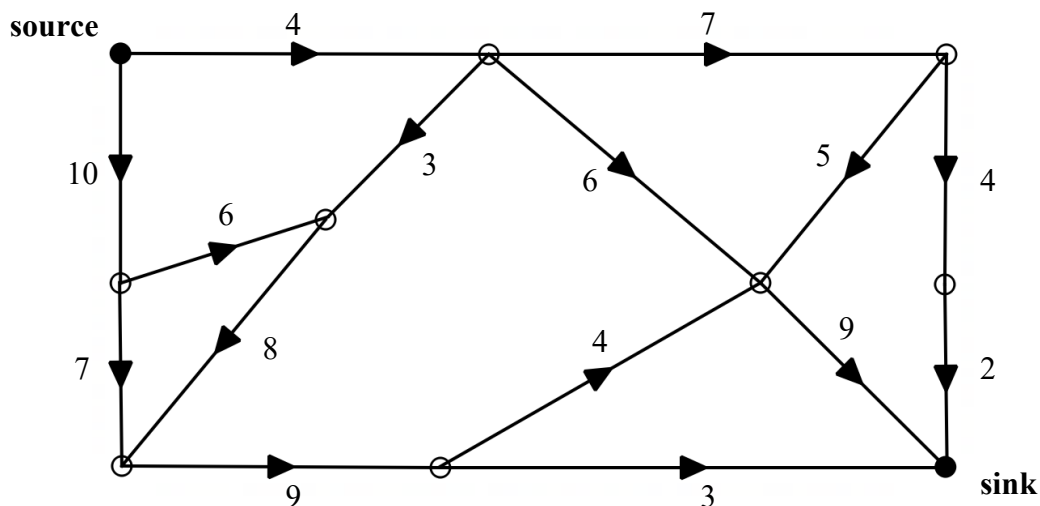
.....

--	--	--	--	--	--	--	--

Student Number

Question 34 (3 marks)

In the network below, the direction and maximum flow possible (in L/min) between vertices is shown.



- (i) By first showing the minimal cut on the above diagram, calculate the maximum flow between the source and the sink. 2

.....

.....

- (ii) Label each edge on the diagram above with the actual flow that achieves the maximum flow through the network. 1

Question 35 (3 marks)

The mass (M) of an earthworm is directly proportional to the square of its length (d).

If an earthworm with a mass of 3.2 g was found to have a length of 8 cm, calculate the length of an earthworm with twice the mass, rounded to one decimal place.

.....

.....

.....

.....

.....

Question 36 (2 marks)

Zoe received \$512.40 as dividends from her shares worth \$3.05 each.
If the shares had a dividend yield of 8%, calculate how many shares Zoe owns.

.....

.....

.....

.....

Question 37 (4 marks)

Alex earned a salary of \$178,000 as well as \$2400 in interest in the last financial year. He spent \$4000 in allowable deductions and donated \$5500 to tax-deductable charities.

Taxable income	Tax on this income
0 – \$18,200	Nil
\$18,201 – \$45,000	16c for each \$1 over \$18,200
\$45,001 – \$135,000	\$4,288 plus 30c for each \$1 over \$45,000
\$135,001 – \$190,000	\$31,288 plus 37c for each \$1 over \$135,000
\$190,001 and over	\$51,638 plus 45c for each \$1 over \$190,000

The above rates **do not** include the Medicare levy of 2%.

Alex is eligible to pay the Medicare levy which is 2% of taxable income. He paid \$46,520 PAYG tax throughout the financial year. Using the above table, determine whether Alex will be given a tax refund or charged a tax bill. Justify using calculations.

.....

.....

.....

.....

.....

.....

.....

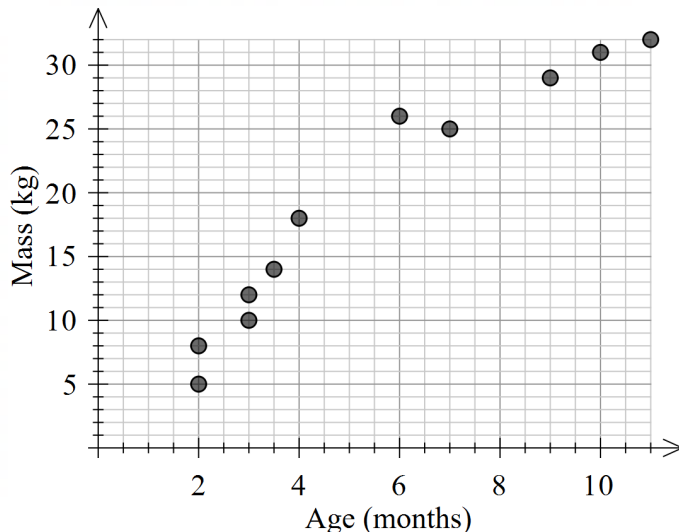
.....

--	--	--	--	--	--	--	--

Student Number

Question 38 (4 marks)

At Monika's Doggy Rescue, the Age (A) of labrador puppies and their Mass (M) was recorded and is displayed in the scatter plot below.



- (i) Calculate the correlation coefficient to three decimal places. 1

.....

- (ii) Write the equation for the least-squares regression line, rounding coefficients to three decimal places. 2

.....

.....

- (iii) Would it be appropriate to use your equation in part (ii) to predict the mass of an 18-month-old labrador? Justify your answer. 1

.....

.....

Question 39 (3 marks)

Solve $\frac{3x-5}{4} + 1 = \frac{5-2x}{5}$

.....

.....

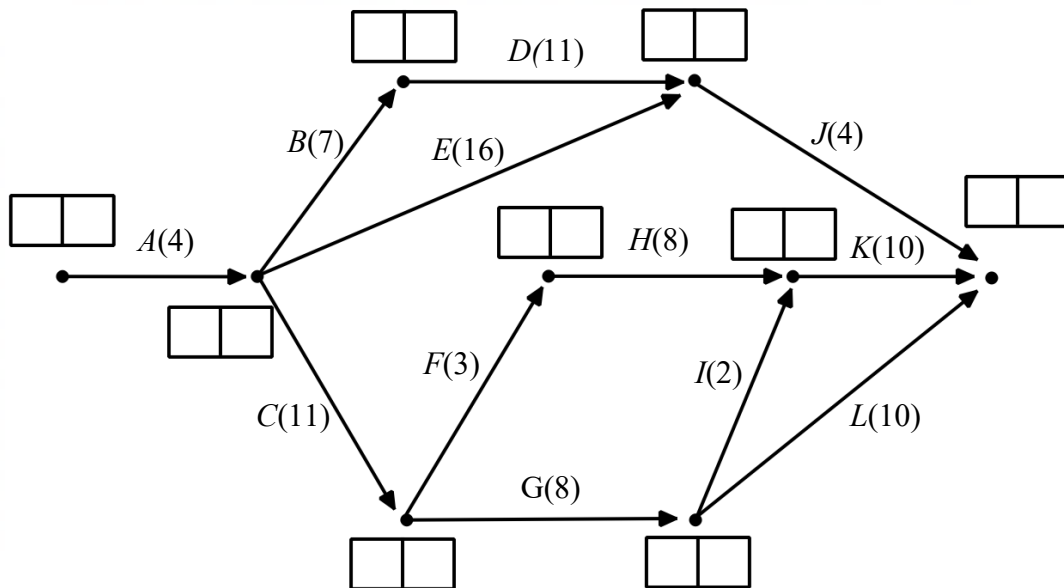
.....

.....

.....

Question 40 (5 marks)

A residential bathroom renovation involves activities *A* to *L*. The diagram shows these activities and their completion times in days.



- (i) Complete the diagram by doing a forwards and backwards scan and hence identify the critical path. 2

.....

.....

- (ii) Identify the activity with the largest float time and calculate its float time. 1

.....

.....

.....

- (iii) If each activity was able to be reduced by only one day, what is the minimum number of activities needing to be reduced to complete the renovation in 31 days? 2
List the activities to be reduced.

.....

.....

.....

.....

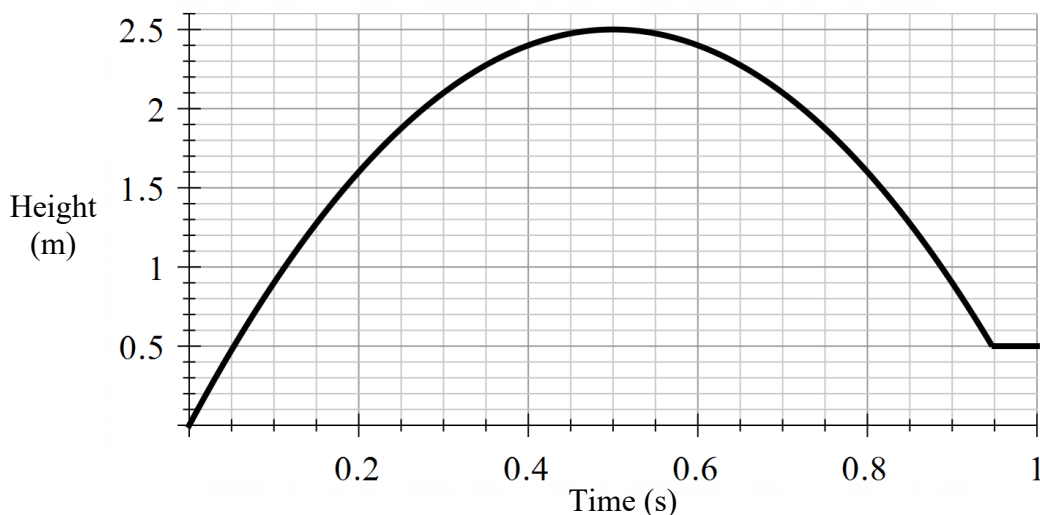
.....

--	--	--	--	--	--	--	--

Student Number

Question 41 (2 marks)

An Olympic high jumper was attempting to clear a bar raised 2.1 m high. The graph below shows their height above the ground over time from leaving the ground until landing on the high-jump mat.



For what percentage of their time in the air was the jumper above the required height? Answer to the nearest percent.

.....

.....

.....

Question 42 (4 marks)

Kathryn has a credit card which has no interest free period. Interest is charged at 7.5% p.a. compounding daily on the amount owing from the purchase date (included) until the end of that month. Any amount still owing is then charged at 15% p.a. compounded daily.

If Kathryn made a \$750 purchase using the card on the 17th of April and had made no purchases or repayments, calculate the interest accrued by the end of the 17th of May.

.....

.....

.....

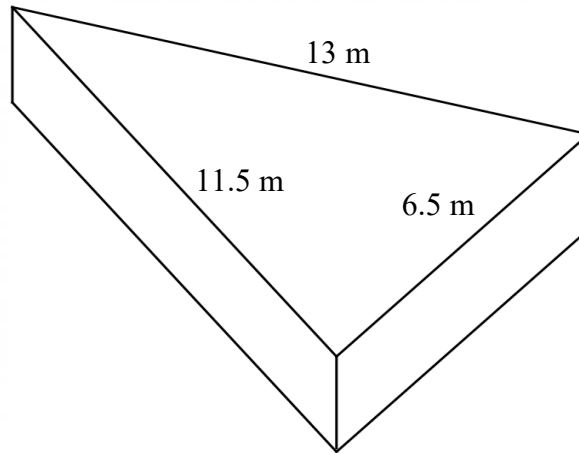
.....

.....

.....

Question 43 (6 marks)

A small triangular dam on a local farm with an unknown depth has its dimensions shown in the diagram below. Initially, it has some water in it.



- (i) Show that the area of the top of the dam is approximately 37.3 m^2 . **3**

.....

.....

.....

.....

.....

.....

- (ii) After 25 mm of rain, the water level of the dam rose by 0.8% above its previous level. **3**
Calculate the total amount of water in the dam after the rain, to the nearest kilolitre.

.....

.....

.....

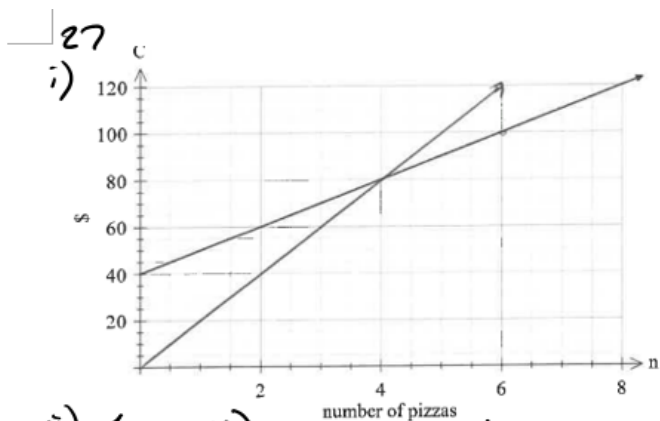
.....

.....

.....

.....

End of Paper



ii) 4 iii) $120 - 100 = \$20$

28. $FV = 120 \times 26.870$
 $= \$3224.40$

29. i)

	range	IQ1
A	9	3
B	11	5

A is more consistent as it has lower spread

ii) $A: 200 \div 50\% = 400$

$B: 200 \div 25\% = 800$

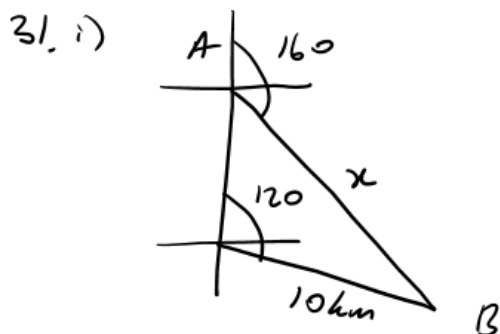
iii) $A: 10 + 1.5 \times 3 = 14.5$
 $B: 9 + 1.5 \times 5 = 16.5$

outlier in A, not B

30. i) $20\% \times 535 = 107$

$x = 107 - 87$
 $= 20$

ii) proportional representation of each year group, to avoid biased sample.



ii) $\frac{x}{\sin(120)} = \frac{10}{\sin(20)}$

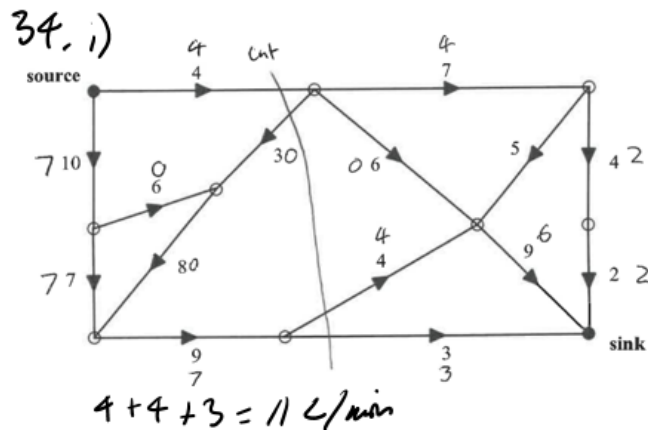
$x = 25 \text{ km}$

32. $x^2 = 29^2 + 41^2 - 2 \times 29 \times 41 \times \cos(120^\circ)$
 $= 3711$

$x = \sqrt{3711}$ $P = 61 + 29 + 41 = 131 \text{ km}$

33. $ACEGM = 39$, $ABEGM = 37$, $ABDFH = 38$

$ABEFM: x + 27 = 36$
 $x = 9 \text{ km}$



ii) above

35. $M = kd^2$ $6.4 = 0.05d^2$
 $3.2 = k \times 8^2$ $d = \sqrt{\frac{6.4}{0.05}}$
 $k = 0.05$ $= 11.3 \text{ cm}$

36. $512.40 \div 8\% = 6405$

$\frac{6405}{3.05} = 2100 \text{ shares}$

37. taxable income = $178000 + 2400 - 4000 - 5500$
 $= 170900$

tax = $31288 + 0.37(170900 - 135000)$
 $= 44571$

$ML = 2\% \times 170900$
 $= 3418$

total owing = $47989 > 46520$
 $\therefore$ tax bill

38. i) $r = 0.961$ ii) $M = 3.275 + 2.876A$

iii) no, as extrapolation is less reliable

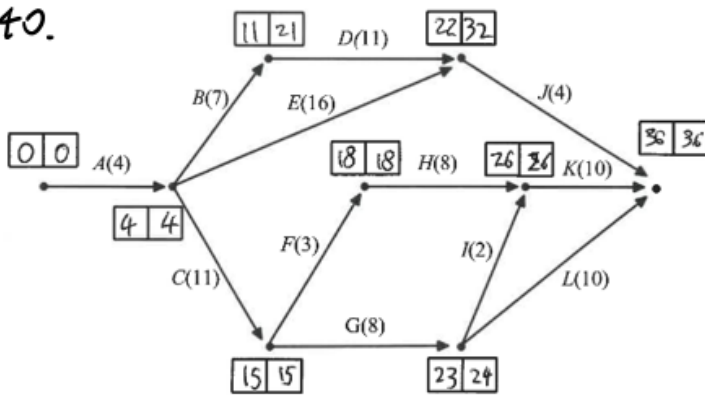
39. $5(3x - 5) + 20 = 4(5 - 2x)$

$15x - 25 + 20 = 20 - 8x$

$23x = 25$

$x = \frac{25}{23}$

40.



i) A-C-F-H-K ii) E (12 days)

iii) A, C, F, H, K and either G or I

41. $\frac{0.7 - 0.3}{0.95} = 42\%$

42. Apr: $750 \left(1 + \frac{7.5\%}{365}\right)^{14} = 752.160...$

May: $752.160... \left(1 + \frac{15\%}{365}\right)^7 = 757.43$

$757.43 - 750 = \$7.43$

43. i) $\cos \theta = \frac{11.5^2 + 6.5^2 - 13^2}{2 \times 11.5 \times 6.5}$

$\theta = \cos^{-1}(0.0367...)$
 $= 87.89^\circ$

$A = \frac{1}{2} \times 11.5 \times 6.5 \times \sin(87.89)$
 $= 37.3 \text{ m}^2$

ii) 25 mm is 0.8%

3125 mm is 100%

$3125 + 25 = 3150 \text{ mm}$

$V = 3.15 \times 37.3$

$= 117.495 \text{ m}^3$

$= 117 \text{ kL}$