Ascham School

NESA Number _____

Teacher LD KS

July 2021
TRIAL EXAMINATION

Mathematics Standard 2

Writing time	2 hours 30 minutes
Reading time	10 minutes
Total Marks	100

General Instructions

- Write using black, non-erasable pen
- Diagrams must be drawn using pencil
- A NESA-approved calculator may be used
- All relevant working should be shown for each question

Additional Materials Needed

- Reference Sheet
- Multiple Choice Answer Sheet

Structure & Suggested Time Spent

- **Section I** (Multiple Choice) **15 Marks**
  Attempt all questions
  Allow about 20 minutes
- **Section II** (Extended Response) **85 Marks**
  Attempt all questions
  Answer in the space provided
  Allow about 2 hours and 10 minutes

Section I	Section II		
Q1 - 15	Q16 - 31	Q32 - 43	TOTAL
/15	/42	/43	/100

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Section I

15 marks
Attempt Questions 1-15
Allow about 20 minutes for this section

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

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

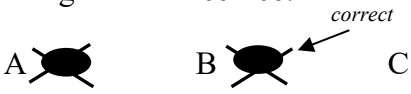
Sample $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you have changed your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:



A ⊗ B ⊗ C ○ D ○

1 A survey asked the following question: 'Who is your favourite teacher?'
How would the responses be classified?

(A) Categorical, nominal

(B) Categorical, ordinal

(C) Numerical, discrete

(D) Numerical, continuous

2 $P\,(30^\circ\text{S}, 100^\circ\text{E})$ is a point on the Earth's surface.
Give the coordinates of the point which is 40° North and 40° West of point P.

(A) $(10^\circ\text{N}, 60^\circ\text{E})$

(B) $(10^\circ\text{N}, 60^\circ\text{W})$

(C) $(10^\circ\text{S}, 140^\circ\text{E})$

(D) $(70^\circ\text{S}, 60^\circ\text{E})$

3 The side length of a square is measured to be 6 cm, correct to the nearest centimetre.
What is the lower limit for the area of the square?

(A) $5.5\,\text{cm}^2$

(B) $22\,\text{cm}^2$

(C) $30.25\,\text{cm}^2$

(D) $42.25\,\text{cm}^2$

4 Ben is the driver at fault in a car accident.
Which of the following is covered by Ben's compulsory third-party (CTP) insurance?

(A) Repairs to Ben's car

(B) Cost of repairing a building damaged in the accident.

(C) Damage to the other driver's car

(D) Injury to the other driver

5 The scale on a map is given as 1 cm **:** 5 km. If the actual distance between two locations is 1250 m, what is the map distance between these two locations?

(A) 2.5 mm

(B) 2.5 cm

(C) 4 mm

(D) 4 cm

6 Amber had 600 ANZ shares valued at $17 400 and received a dividend of 90 cents per share.
What is the dividend yield correct to 1 decimal place?

(A) 0.5 %

(B) 3.1 %

(C) 3.2 %

(D) 5 %

7 In making y the subject of the equation $2x - 5y - 1 = 0$, which of the following is correct?

(A) $y = \dfrac{2x + 1}{-5}$

(B) $y = \dfrac{2x - 1}{-5}$

(C) $y = \dfrac{1 - 2x}{5}$

(D) $y = \dfrac{2x - 1}{5}$

8 The table shows future value interest factors.

An instalment of \$40 000 is invested into an annuity every six months for two years.
The annuity earns interest at a rate of 2% per annum, compounded six-monthly.

Using the data from the table, what is the future value of this annuity?

(A) \$80 400

(B) \$80 800

(C) \$162 416

(D) \$164 864

	Interest rate per period					
Period	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746

9 The mean of a set of ten scores is 6. When another two scores are added to the set, the new mean is 8.

What is the mean of the two additional scores?

(A) 12

(B) 18

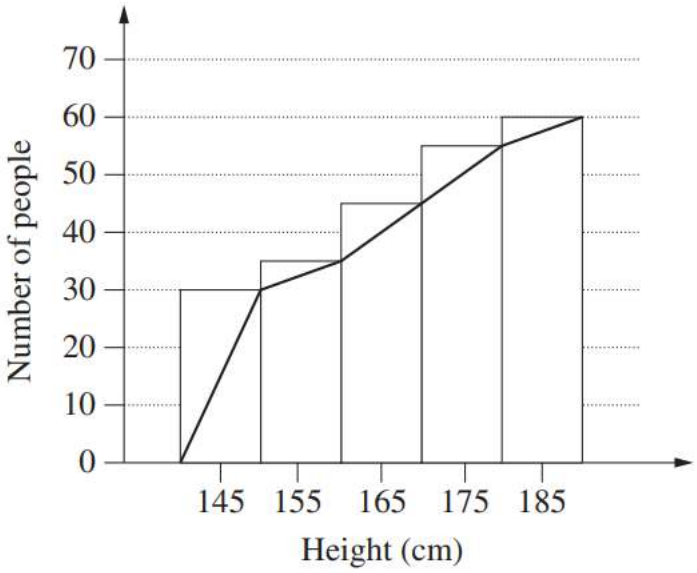
(C) 36

(D) 48

10 The heights of a random sample of 60 visitors to Luna Park were recorded.
These results were grouped and then displayed as a cumulative frequency histogram and ogive.
The shortest visitor was 140 cm and the tallest was 190 cm.

What is the best estimate for the median height?

Heights of visitors at Luna Park



(A) 30 cm

(B) 150 cm

(C) 160 cm

(D) 165 cm

11 The table below shows the mean and standard deviation in three HSC subjects.

Subject	Mean	Standard Deviation
Mathematics Standard	68	14
Biology	60	12
Art	55	10

Stella's marks were: Mathematics Standard = 80
Biology = 70
and Art = 65

In which subject did Stella achieve the best result?

(A) There is not enough information.

(B) Mathematics Standard

(C) Biology

(D) Art

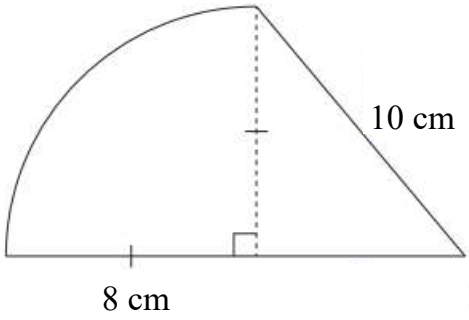
12 A shape consisting of a quadrant and a right-angled triangle is shown.
What is the area of this shape, correct to the nearest square centimetre?

(A) $37\,cm^2$

(B) $74\,cm^2$

(C) $82\,cm^2$

(D) $90\,cm^2$



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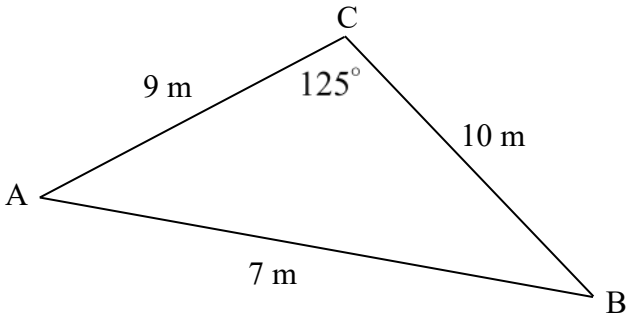
13 What is the area of this triangle to the nearest square metre?

(A) $26\ m^2$

(B) $36\ m^2$

(C) $37\ m^2$

(D) $45\ m^2$



Not to scale

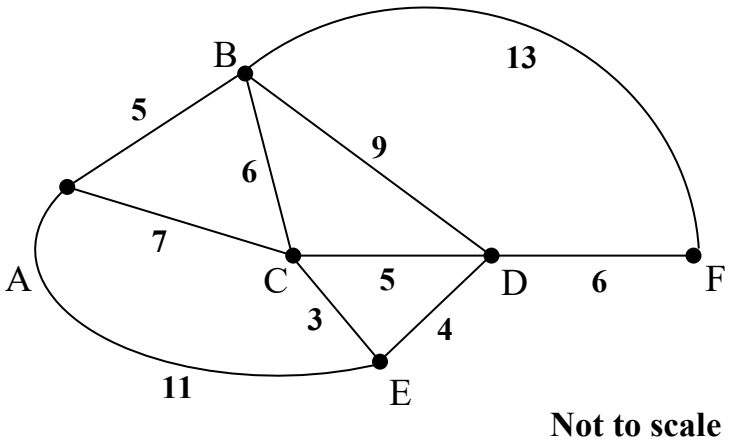
14 What is the weight of the minimum spanning tree for this network?

(A) 23

(B) 24

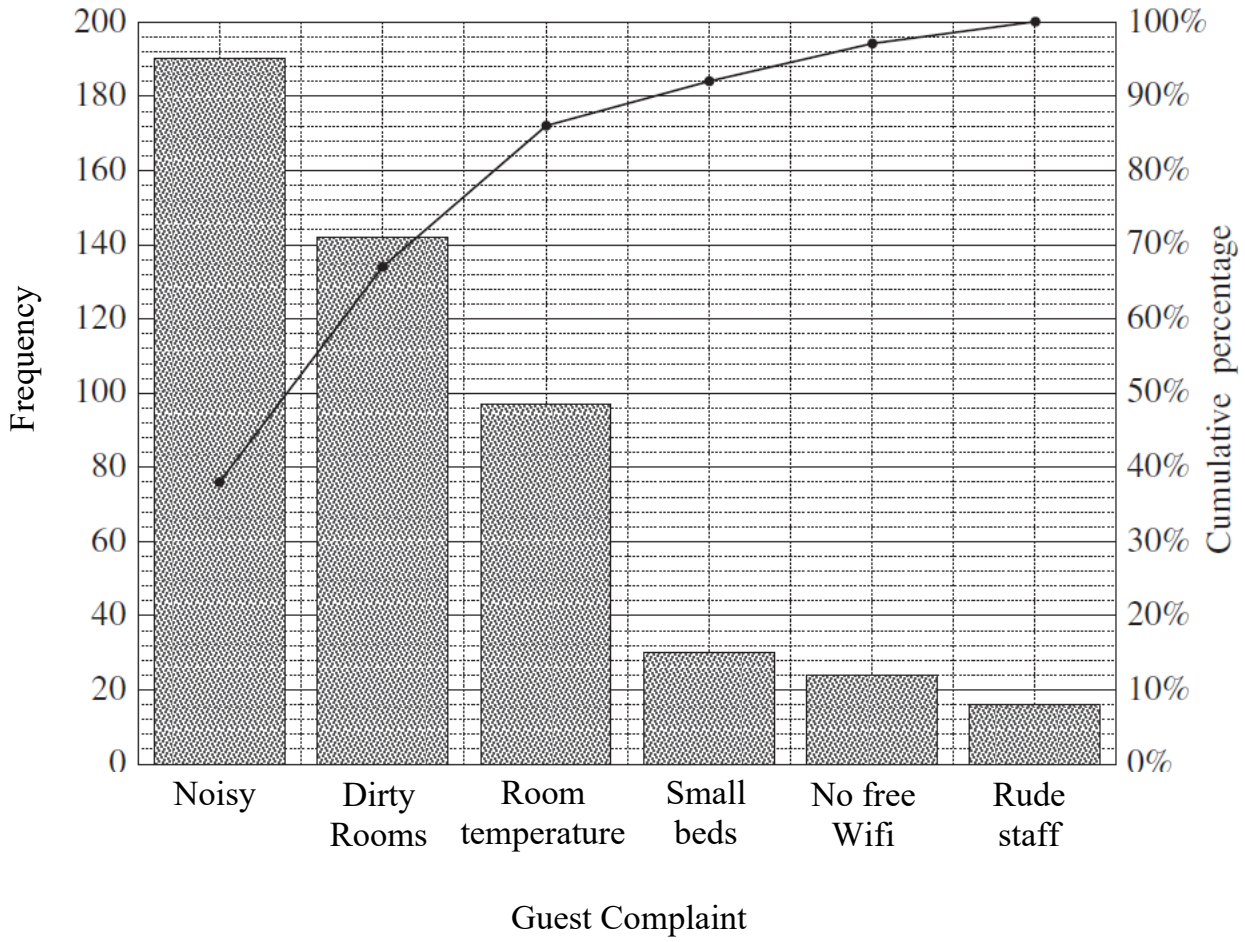
(C) 25

(D) 26



Not to scale

15 A hotel manager wanted to identify the main reasons for guest complaints.
A survey was conducted and the results are shown in the Pareto chart below:



What percentage of guests complained about small beds?

(A) 3%

(B) 12%

(C) 6%

(D) 15%

End of Section I

Section II

85 marks

Attempt all questions

Allow about 2 hours and 10 minutes for this section

Answer each question in the space provided.

Show all relevant working in questions involving calculations.

Marks

16 The mass of a refrigerator is 200 kg, rounded to the nearest 10 kg. Calculate the percentage error correct to 1 decimal place. **2**

17 Coordinated Universal Times for the following cities are:

Sydney (NSW):	UTC +10
Brisbane (QLD):	UTC +10
Auckland (NZ) :	UTC +12

Between October and March, NSW and New Zealand have daylight saving of +1 hour. Queensland (QLD) does not have daylight saving.

(a) In May, when it is Sunday 1:00 am in Auckland (NZ), what is the local time and day in Sydney (NSW)? **1**

(b) In January, Mick wanted to call his cousin in Auckland to wish him a Happy New Year. If it is 9:00 am in Brisbane when Mick calls, what is the time in Auckland? **1**

18 Jake commutes from the Central Coast to Sydney for his job.
He drives an average of 400 km per week and the average cost of petrol is $1.40/L.

Jake's car is serviced every 10 000 km which costs $250 each time.
His car's fuel consumption is 12 L/100 km.

(a) What is the annual cost to service the car? **1**

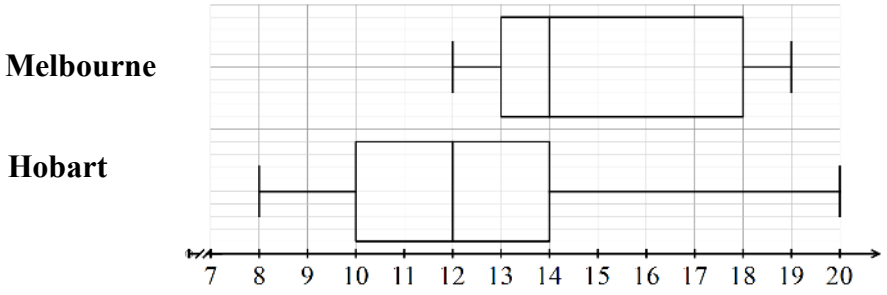
(b) Calculate the average annual cost of petrol. (Assume 1 year = 52 weeks) **2**

19 Jill is about to go on holidays for four weeks. Her weekly salary is $1260 and her holiday loading is 17.5% of four weeks' pay. **2**

What is Jill's total pay for the four weeks holiday?

20 In Australia, the winter months of June, July and August total 92 days.
The box plots below display data on the maximum daily temperatures in Melbourne and Hobart during the winter months last year.

Maximum Temperatures (^{o}C) in Winter



(a) What percentage of Hobart winter days were colder than Melbourne's coldest day? **1**

(b) How many Melbourne winter days were at least $18^{o}C$? **1**

(c) Determine if the maximum temperature of $20^{o}C$ in Hobart is an outlier. **2**
Show clear calculations and reasoning to support your answer.

21 Solve the equation: $\frac{m+3}{2} - m = 5$ **3**

22 At the beginning of the year, Ms. Moneypenny bought 1000 shares priced at \$8.40 each. Brokerage fees were charged at 2% of the purchase price. **2**

Six months later, Ms. Moneypenny sold her shares at \$12.60 each. There were no brokerage fees incurred for the sale.

Calculate Ms. Moneypenny's total profit for the year.

23 Juliette buys a television which uses 100 watts/hour when it is being used for viewing. In stand-by mode it uses 5 watts/hour. **2**

On average, Juliette and her family use the TV for viewing for 6 hours a day and leave it on standby for the remaining time.

If the price of electricity is 30 cents per kWh, calculate the cost of running the TV for a year. (Assume there are 365 days in a year).

24 Chloe's taxable income is $94 825 in a particular year. The table below is used to calculate her tax payable. In addition, she pays the Medicare levy, which is 2% of her taxable income. Calculate Chloe's net income in that year. **3**

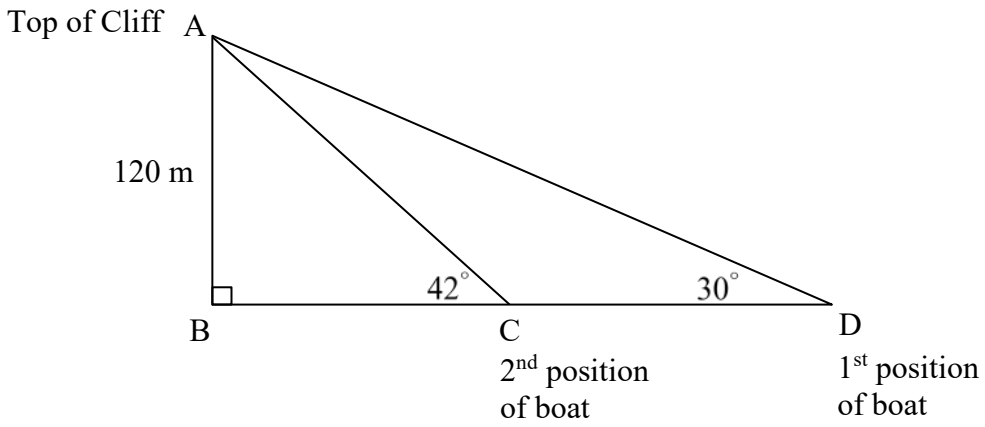
Taxable income	Tax on this income
$0–$18 200	Nil
$18 201–$37 000	19c for each $1 over $18 200
$37 001–$87 000	$3572 plus 32.5c for each $1 over $37 000
$87 001–$180 000	$19 822 plus 37c for each $1 over $87 000
$180 001 and over	$54 232 plus 47c for each $1 over $180 000

25 Mia's next holiday is to the island of Tahiti, which has position coordinates $(17^\circ S, 149^\circ W)$. Mia lives in Sydney, which has position coordinates $(34^\circ S, 151^\circ E)$. The plane departs Sydney at 6:00 am Saturday and the flight time is 9 hours. **3**

What will be the local time and day in Tahiti when Mia arrives?

26 What percentage change is equivalent to a decrease of 20%, followed by an increase of 20%? **2**

27 The top of a cliff, A, is 120 m above the sea at B. The angle of elevation to A from a boat at D is 30°.
After travelling directly towards the cliff to C, the angle of elevation from the boat to the top of the cliff is 42°.



How far did the boat travel towards the cliff between point D and point C? **3**
Answer correct to the nearest metre.

28 Stephen has a mass of 85 kg and holds a provisional driver's license.
On a Friday night, he started drinking alcohol at 7 pm.
By 9 pm, his blood alcohol content (BAC) was 0.06.

(a) Use the formula below to calculate how many standard drinks must Stephen have consumed between 7 pm and 9 pm. Give your answer correct to the nearest whole drink. **3**

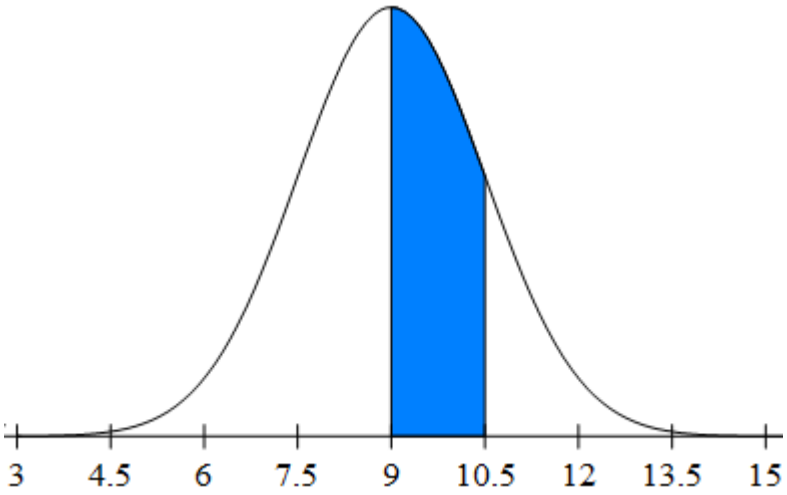
$$BAC_{male} = \frac{10N - 7.5H}{6.8M}$$

(b) Stephen knows that his blood alcohol content must be zero before he can drive. **1**
The number of hours before a zero BAC is reached can be calculated using the formula below:

$$\text{Number of hours} = \frac{\text{BAC}}{0.015}$$

Use the formula to find the earliest time Stephen can drive home.

29 The bell-shaped curve shows the distribution of the weights of 2000 packages received by the Australian customs service during one week.



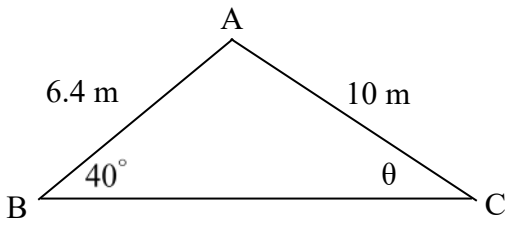
The data is normally distributed with a mean of 9 kg and a standard deviation of 1.5 kg.

(a) What is the weight of a package with a z-score of 2.5 ? **2**

(b) How many packages were received during the week with weights within the range represented by the shaded section? **1**

(c) What percentage of the packages weighed more than 7.5 kg? **1**

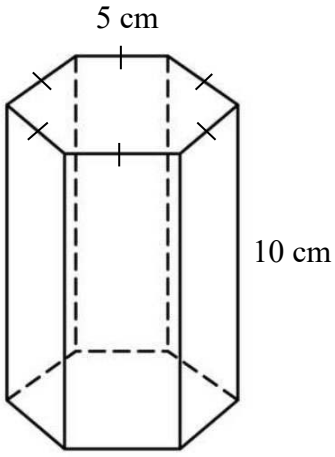
30 Triangle ABC is shown. Calculate the size of angle θ, to the nearest degree. **2**



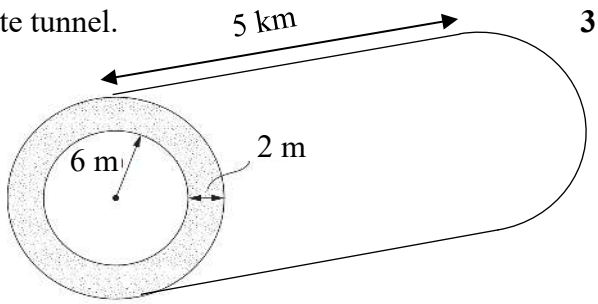
NOT TO SCALE

31 To gain a certificate of High Distinction in a prestigious Mathematics competition, a participant needs to achieve a score in the top 2.5% of the cohort. If participants' scores were normally distributed with a mean of 60 and a standard deviation of 12, a participant would have to score above what value to earn a High Distinction? **1**

32 The diagram below shows a regular hexagonal prism. **3**
The side lengths of the hexagon are 5 cm each and the height of the prism is 10 cm.
If the volume of this prism is approximated to 650 cm^3, calculate the total surface area.



33 The state government is designing a 5 km concrete tunnel. **3**
The tunnel has an internal radius of 6 m and a wall thickness of 2 m as shown in the diagram.
What is the volume of concrete needed to build this tunnel?
Give your answer correct to the nearest m^3.



34 The table below compares the heights of mothers with the heights of their sons. All heights are in centimetres.

Mother's height (*m*)	156	158	162	164	166	168	170
Son's height (*S*)	172	176	178	180	176	185	184

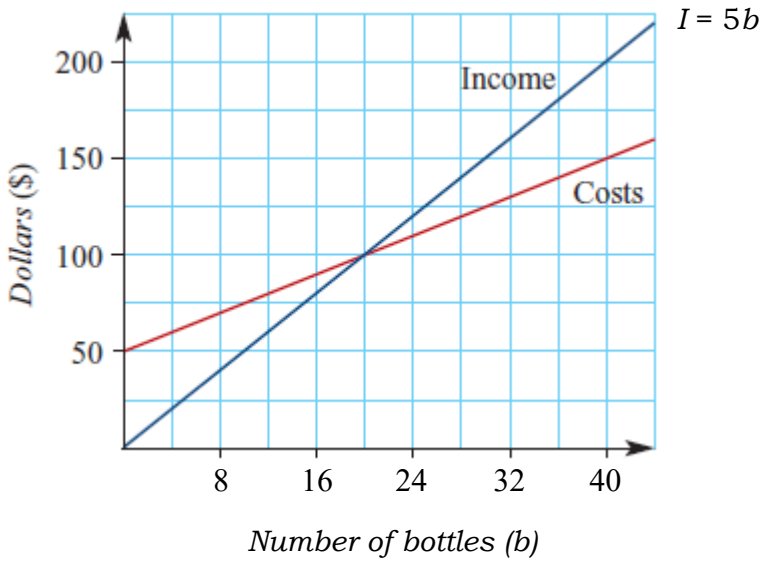
(a) Calculate the correlation coefficient (r) between m and S. **1**
Give your answer correct to 2 decimal places.

(b) Comment on the strength of the association between m and S. **1**

(c) Use your calculator to find the equation of the least-squares line of best fit for a son's height (S) in terms of his mother's height (m). **2**

(d) Use your equation to predict a son's height if his mother's height is 175 cm. **1**
Give your answer to the nearest centimetre.

35 The graph below shows the cost of producing bottles of Kombucha and the income received from its sales.



(a) Use the graph to determine the number of bottles that need to be sold to break even. **1**

.....

(b) How many bottles need to be sold to give a $50 profit? **1**

.....

(c) The equation that describes the relationship between the Income (I) and the Number of bottles sold (b) is: $I = 5b$. **2**

Write an equation to describe the relationship between the Costs (C) and the Number of bottles (b).

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(d) If the relationship between Costs and Income continues as graphed above, calculate the profit which should be made when 500 bottles are sold. **2**

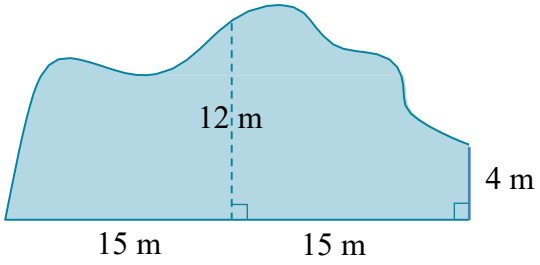
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36 The diagram shows the top view of the surface of a lake. **3**



The average depth of the lake is 3 metres.

Use two applications of the trapezoidal rule to find an estimate of the volume of water in the lake.

Give your answer in kilolitres.

37 The table below shows the monthly payments for every $1000 borrowed at varying reducible interest rates.

	Number of years			
Rate p.a.	**15**	**20**	**25**	**30**
4%	7.40	6.06	5.28	4.77
4.5 %	7.65	6.33	5.56	5.07
5 %	7.91	6.60	5.85	5.37
5.5 %	8.17	6.88	6.14	5.68
6 %	8.44	7.16	6.44	6.00

Claudia borrows $450 000 to buy a house at 5% p.a. over a period of 30 years.

(a) How much interest can Claudia expect to pay over the term of the loan? **2**

(b) How much would Claudia save in interest if she repaid the loan over 20 years instead of 30 years? **1**

38 The tables below show the **future value** and **present value** of an **annuity** with a contribution of **$1 per period.**

Use the tables to answer the questions on the following page.

Future value interest factors

(Future value of an annuity with a contribution of $1 at the end of each period)

Period	Interest rate per period							
	1%	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600	2.0700	2.0800
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938	8.6540	8.9228
8	8.2857	8.5830	8.8923	9.2142	9.5491	9.8975	10.2598	10.6366
9	9.3685	9.7546	10.1591	10.5828	11.0266	11.4913	11.9780	12.4876
10	10.4622	10.9497	11.4639	12.0061	12.5779	13.1808	13.8164	14.4866
11	11.5668	12.1687	12.8078	13.4864	14.2068	14.9716	15.7836	16.6455
12	12.6825	13.4121	14.1920	15.0258	15.9171	16.8699	17.8885	18.9771

Present value interest factors

(Present value of an annuity with a contribution of $1 at the end of each period)

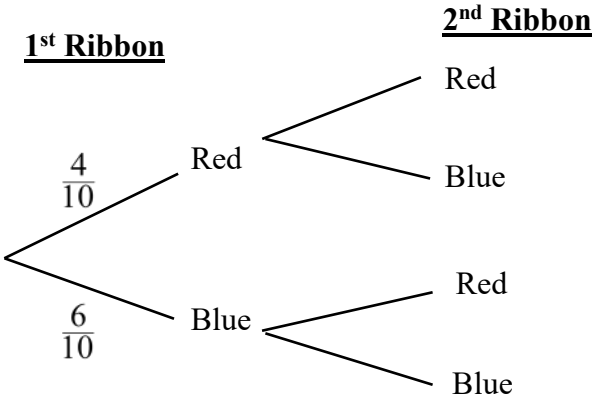
Period	Interest rate per period							
	1%	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361

(a) Tilly wants to save $10 000 over 2 years for a round-the-world trip. She makes regular contributions every quarter into an account which pays interest at 4% p.a. How much will Tilly need to contribute each quarter to reach her savings goal? **2**

(b) What single amount could Tilly invest now, at the same rate over the same time, to raise the $10 000 needed for her trip? **1**

39 A drawer contains 4 red and 6 blue hair ribbons. Two ribbons are selected at random without replacement.

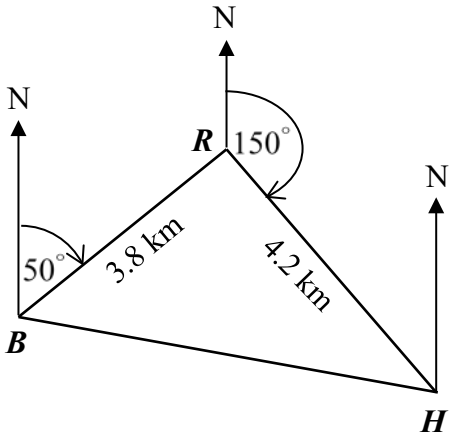
(a) Complete the probability tree diagram by writing the probabilities on each branch in the second selection. **2**



(b) Find the probability that 2 ribbons of the same colour are chosen. **2**

40 A helicopter left its base at ***B*** and flew 3.8 km on a bearing of 050° to a rescue site ***R***.

After picking up a group of injured people, the helicopter flew on a bearing of 150° to the hospital ***H*** which was 4.2 km away.



NOT TO SCALE

The helicopter then returned to the rescue site to pick up a second group of people.

a) On what bearing does the helicopter need to fly to return to **R** from **H** ? **1**

b) Calculate the distance between the helicopter base at ***B*** and the hospital at ***H***.
Give your answer correct to the nearest metre. **3**

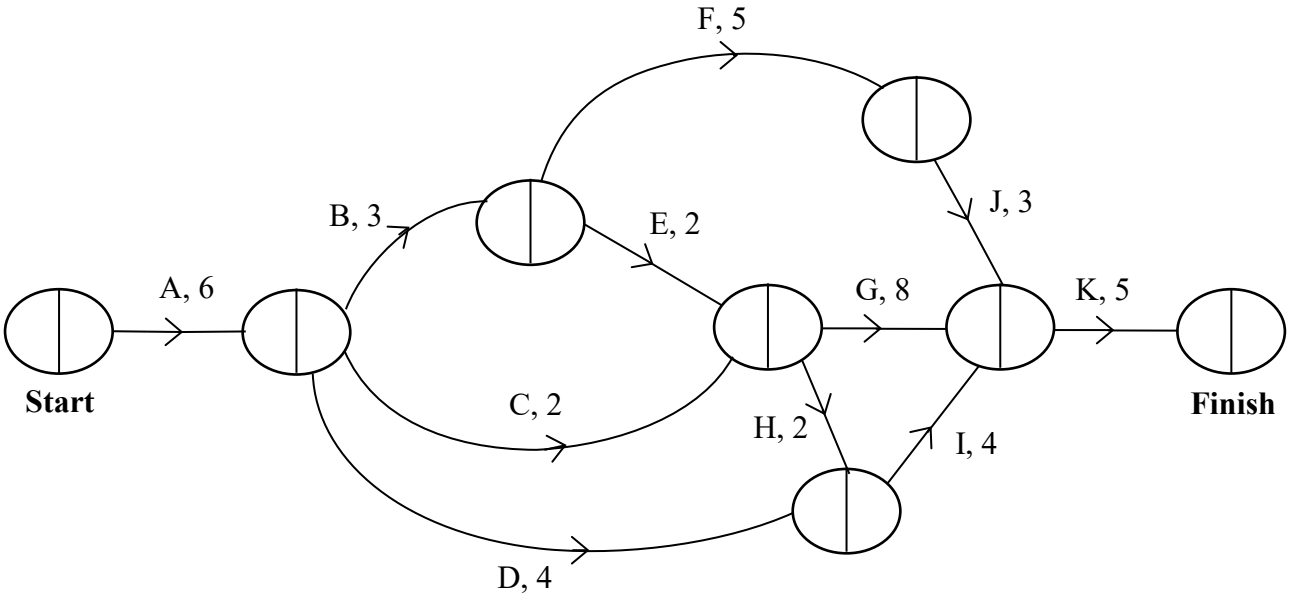
41 A project requires 6 activities, A to F, to be completed. The activity chart shows the immediate predecessors and duration of each activity.

Activity	Immediate Predecessor(s)	Duration in hours
A	-	3
B	A	5
C	A	8
D	B	4
E	C, D	6
F	E	2

By drawing a network diagram, determine the minimum time for the project to be completed. **3**

Minimum time = ……

42 The network below is used to represent the activities in a project.
The time for each activity is given in days.

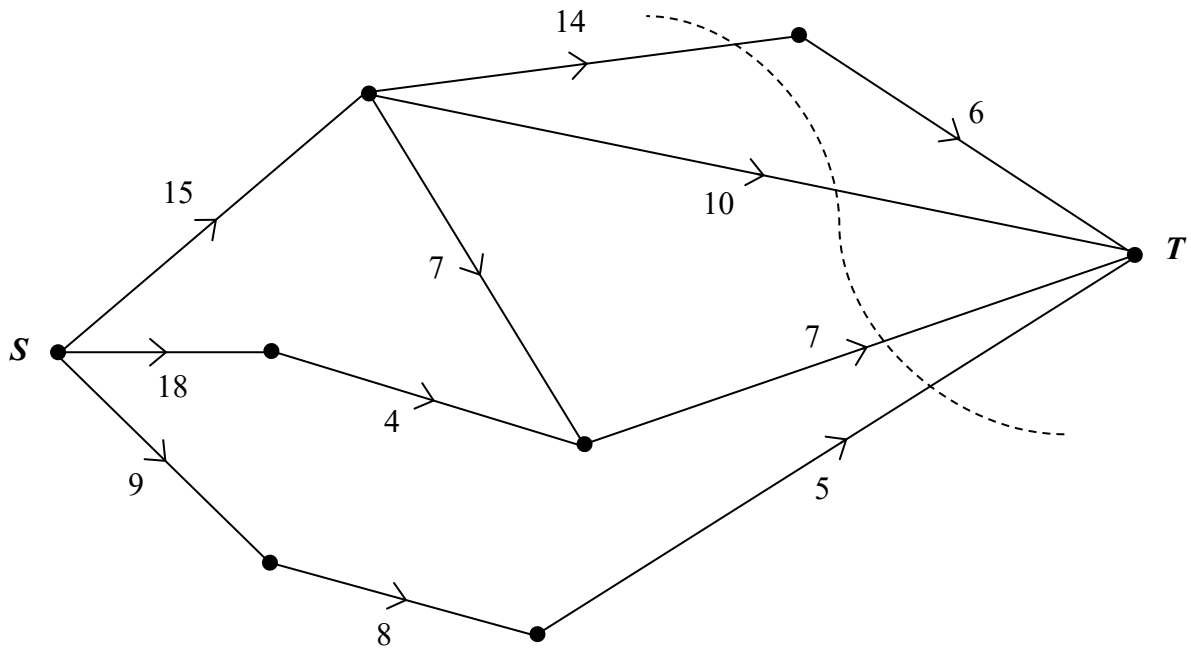


(a) Complete a forward scan on the diagram above and determine the critical time for the project. **2**

(b) Complete a backward scan on the diagram above. **1**

(c) Calculate the float time for activity F. **1**

43 The diagram below shows a directed network. The source is at ***S*** and the sink is at ***T***.



(a) What is the capacity of the cut shown? **1**

(b) What is the maximum flow of this network? **1**

END OF EXAM