Centre Number

Student Number

CATHOLIC SECONDARY SCHOOLS
ASSOCIATION OF NSW

2011
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

General Mathematics

Morning Session
Monday 8 August 2011

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using blue or black pen
- Calculators may be used
- Use Multiple Choice Answer Sheet provided
- A separate Formula Sheet is provided
- Write your Centre Number and Student Number at the top of this page

Total marks: 100

Section I Pages 2–10

22 marks
- Attempt Questions 1–22
- Allow about 30 minutes for this section

Section II Pages 11–23

78 marks
- Attempt Questions 23–28
- Allow about 2 hours for this section

Section I

22 marks
Attempt Questions 1–22
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1-22.

1 Zoe works as a sales assistant in a car yard. Her income is a percentage of the sale price of the cars she sells.

Which term best describes her income?

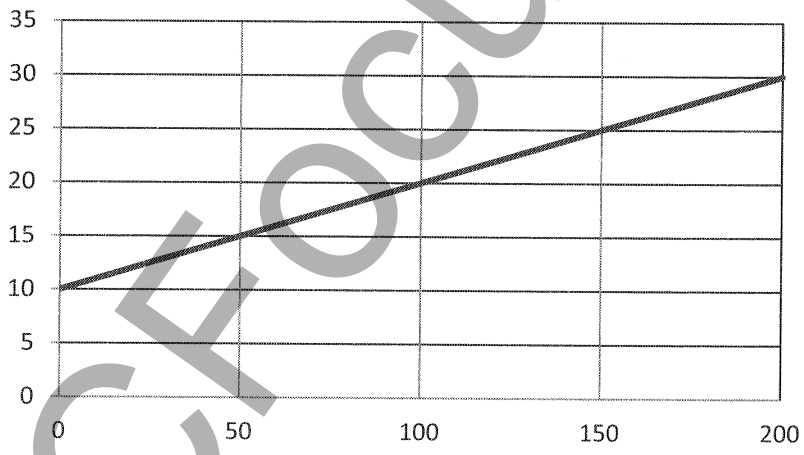
(A) Wage

(B) Salary

(C) Overtime

(D) Commission

2



What is the gradient of the line above?

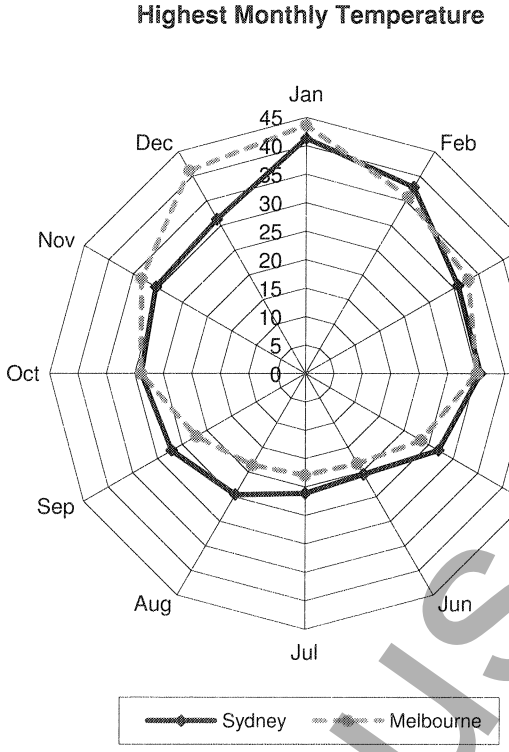
(A) $\frac{1}{10}$

(B) $\frac{1}{8}$

(C) $\frac{3}{20}$

(D) 10

3 The radar chart below represents the highest monthly temperature for Sydney and Melbourne for 2010.



In which month was the difference in the highest monthly temperatures the greatest?

(A) January

(B) April

(C) August

(D) December

4 What is the surface area of a cube with a side length of 8 cm?

(A) 48 cm^2

(B) 64 cm^2

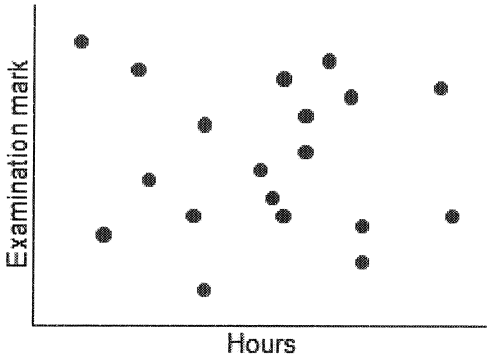
(C) 384 cm^2

(D) 512 cm^2

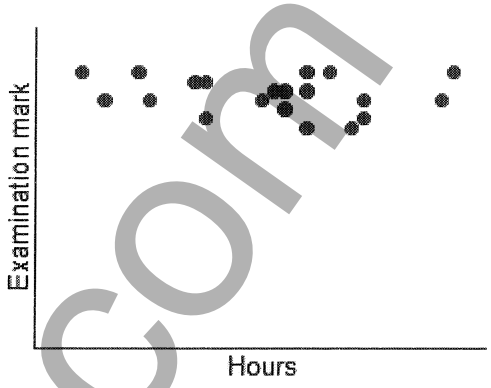
5 Some researchers assume that there is a negative correlation between examination success and hours spent on social networking.

Which of the following scatter graphs best shows this correlation?

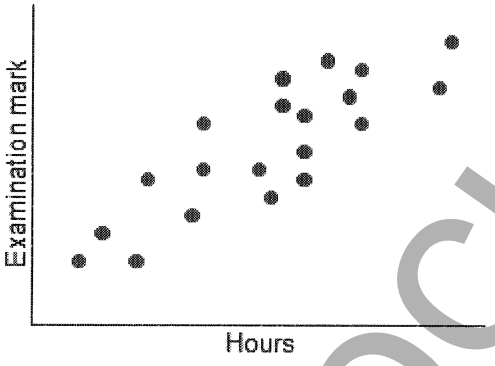
(A)



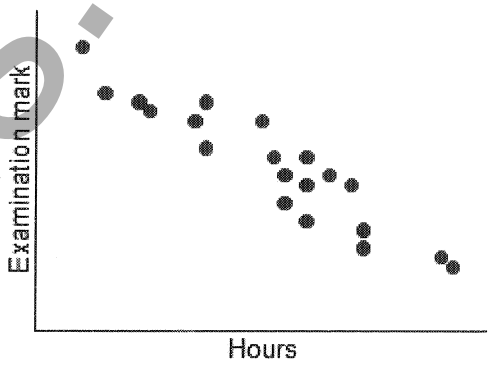
(B)



(C)



(D)



6 Joel and Suzie are purchasing a unit for $300 000. The bank lends them $200 000 at 8 % p.a. compounding monthly, to be repaid in equal monthly instalments over 25 years.

Which formula would be used to calculate the value of their monthly instalment?

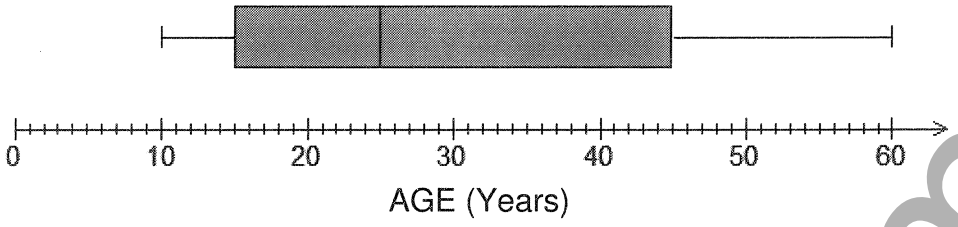
(A) $I = \Pr n$

(B) $N = \dfrac{A}{(1+r)^n}$

(C) $A = M\left\{\dfrac{(1+r)^n - 1}{r}\right\}$

(D) $N = M\left\{\dfrac{(1+r)^n - 1}{r(1+r)^n}\right\}$

7 The ages of 80 people at a screening of the movie "Gulliver's Travels" are shown in the box-and-whisker plot below.



How many people are aged between 15 and 25?

(A) 10

(B) 20

(C) 40

(D) 60

8 An unbiased coin was tossed 30 times. The results were 21 heads and 9 tails.

Which of the following statements is true regarding the next time the coin is tossed?

(A) There is no way to tell which result is more likely.

(B) The result is more likely to be tails.

(C) The result is more likely to be heads.

(D) The coin has an equal chance of showing either heads or tails.

9 In a recent examination, the mean and standard deviation of the General Mathematics marks were 68 and 12 respectively.

If Stephanie's mark corresponded to a z-score of 0.8, which of the following is closest to the mark she achieved?

(A) 56

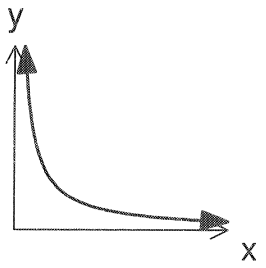
(B) 68

(C) 78

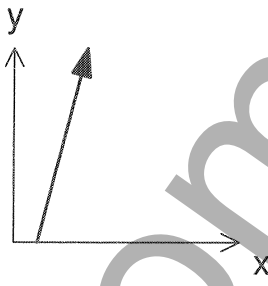
(D) 80

10 Which graph best represents the equation $y = \frac{4}{x}$? $(x > 0)$

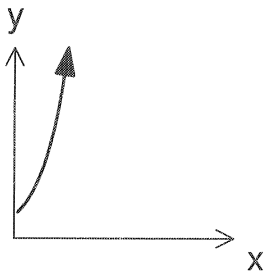
(A)



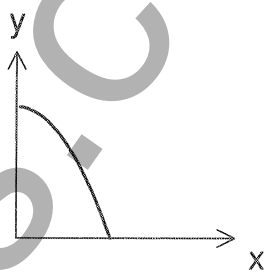
(B)



(C)



(D)



11 The chance of an aeroplane arriving late from any flight is 15%. Over a 4 day period, 10 aeroplanes each complete 4 flights per day.

How many flights would you expect to be late over this period?

(A) 2

(B) 24

(C) 42

(D) 48

12 The time in the town of Saka is 1 hour and 48 minutes behind the city of San Paulo. The co-ordinates of San Paulo are (10°S, 55°W).

What are the co-ordinates of Saka?

(A) (10°S, 82°W)

(B) (10°S, 28°W)

(C) (37°S, 55°W)

(D) (37°S, 28°W)

13 The table below shows the compound interest on $1 for different interest rates and terms.

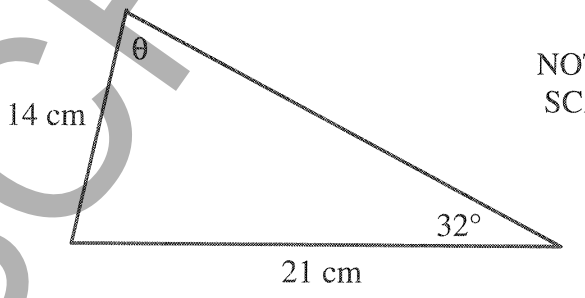
Term \ Rate	2%	3%	4%	5%	6%
2	1.0404	1.0609	1.0816	1.1025	1.1236
4	1.0824	1.1255	1.1699	1.2155	1.2625
6	1.1261	1.1941	1.2653	1.3401	1.4185
8	1.1717	1.2668	1.3686	1.4775	1.5938
10	1.2190	1.3439	1.4802	1.6289	1.7908

Felicity invests $15 000 at 6 % p.a. compounding half-yearly for 4 years.

What value in the table would be used to calculate the total value of the investment?

(A) 1.1255
(B) 1.2625
(C) 1.2668
(D) 1.5938

14 What is the size of the angle θ in the following triangle to the nearest degree?



NOT TO SCALE

(A) 53°
(B) 95°
(C) 113°
(D) 116°

15 On a shelf in the library there are 12 books numbered 1 to 12.

If a person borrowed 2 of these books, what is the probability that they took home books 3 and 6?

(A) $\frac{1}{144}$

(B) $\frac{1}{132}$

(C) $\frac{1}{66}$

(D) $\frac{1}{6}$

16 Which of the following statistical measures must be a score in any set of discrete data?

(A) Mode

(B) Range

(C) Median

(D) Mean

17 A car is travelling along the freeway at 95 km/h.

What is the car's approximate speed in m/s?

(A) 1.6 m/s

(B) 16.8 m/s

(C) 26.4 m/s

(D) 342 m/s

18 Emma has a new credit card that has no interest-free period and charges 15.6% p.a. flat rate interest on all purchases. Interest is charged on amounts from (and including) the date of purchase up to (and including) the payment date.

On 16th June Emma uses her credit card for the first time to buy a pair of boots for $230.

If she makes no further purchases, what amount would Emma need to repay if she wants to pay the outstanding balance on the 2nd July?

(A) $231.57

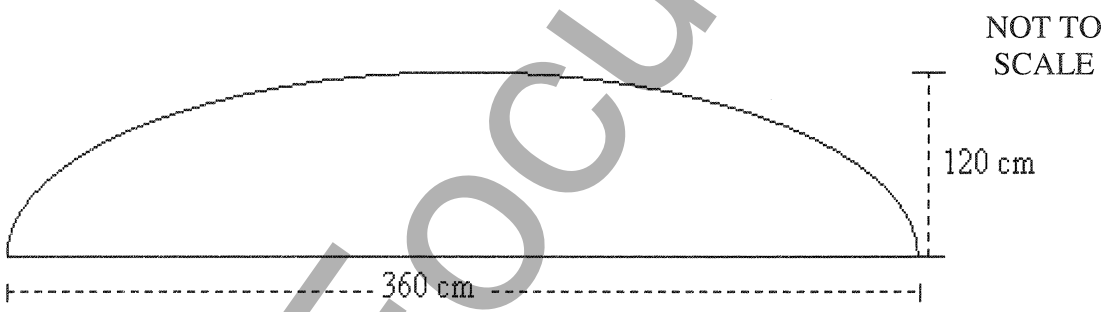
(B) $231.67

(C) $265.88

(D) $839.96

19 Joe has been asked to make and paint a sign in the shape of half an ellipse.

What is the cost of painting his sign if it has the dimensions shown below and the paint costs $5.60 per square metre?



(A) $19.00

(B) $38.00

(C) $1900.00

(D) $3800.00

20 Sam bought a new washing machine for his dry cleaning business. The washing machine depreciates at 15% per annum using the declining balance method.

Approximately how many years will it take for the washing machine to be worth half its purchase price?

(A) 0.4

(B) 4.3

(C) 6.6

(D) More information is required.

21 Bacteria are one of the smallest living things. The volume of one bacterium is 6.5×10^{-8} m^3. The volume of bacteria in 1 L of sea water is 3.25×10^{-2} m^3.

How many bacteria will be found in 200 mL of sea water?

(A) 50 000

(B) 100 000

(C) 500 000

(D) 1 000 000

22 Which of the following correctly expresses Y as the subject of $E = A(S-3Y)$?

(A) $Y = \dfrac{E-AS}{3A}$

(B) $Y = \dfrac{E}{3A} + \dfrac{S}{3}$

(C) $Y = \dfrac{AS-E}{3A}$

(D) $Y = \dfrac{E-A-S}{-3}$

Section II

78 marks
Attempt Questions 23–28
Allow about 2 hours for this section

Answer each question in the appropriate writing booklet. Extra writing booklets are available.

All necessary working should be shown in every question.

Question 23 (13 marks) Use a SEPARATE writing booklet.

(a) The scale on a map is 1:250 000. The distance between George Town and Reading on the map is measured to be 6.2 cm. **2**

What is the actual distance between George Town and Reading in kilometres?

(b) The number of goals scored by Nathan in each soccer game last season is recorded in the frequency distribution table below.

The mean of the data is approximately 1.96.

Score	*Frequency*
0	6
1	4
2	5
3	3
4	6

(i) Is the collected data above continuous or discrete? Explain your answer. **1**

(ii) Calculate the population standard deviation, correct to TWO decimal places. **1**

(iii) Nathan's friend, Matthew, plays for another soccer team. **1**

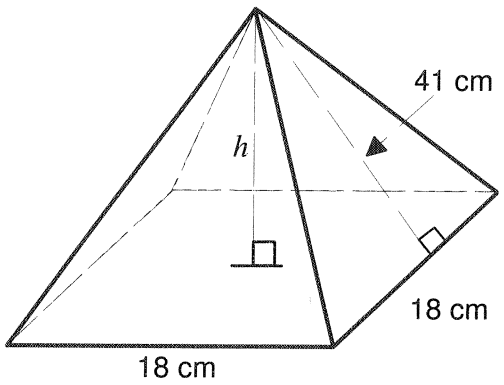
The mean and population standard deviation for Matthew's season were 1.42 and 0.8 respectively.

Who was the more consistent goal scorer? Justify your answer.

Question 23 continues on Page 12

Question 23 (continued)

(c) A chocolate box is in the shape of a square pyramid.



(i) Show that the perpendicular height (h) of the pyramid is 40 cm. **1**

(ii) The chocolate box will be filled with liquid chocolate? **1**

How much chocolate is required to fill the box? Give your answer in millilitres. ($1\ cm^3 = 1mL$)

(d) Mario works as a sign-writer and earns a salary of \$52 000 per annum. In one year he has investments which earn \$435 and allowable taxable deductions of \$1500.

Taxable income	*Tax on this income*
0 – \$35,000	29c for each \$1
\$35,001 – \$80,000	\$10,150 plus 30c for each \$1 over \$35,000
\$80,001 – \$180,000	A plus 38c for each \$1 over \$80,000
\$180,001 and over	\$61,650 plus 45c for each \$1 over \$180,000

(i) Show that Mario's taxable income is \$50 935. **1**

(ii) Using the tax table above, calculate the income tax payable on Mario's taxable income. **1**

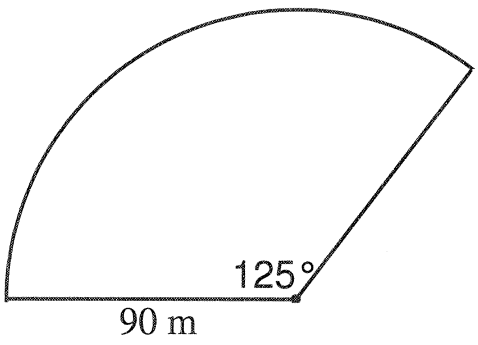
(iii) Find the value of A in the above table. **2**

Question 23 continues on Page 13

Question 23 (continued)

(e) A javelin field is in the shape of a sector of a circle with radius of 90 metres. **2**

Find the perimeter of this field, correct to TWO decimal places.



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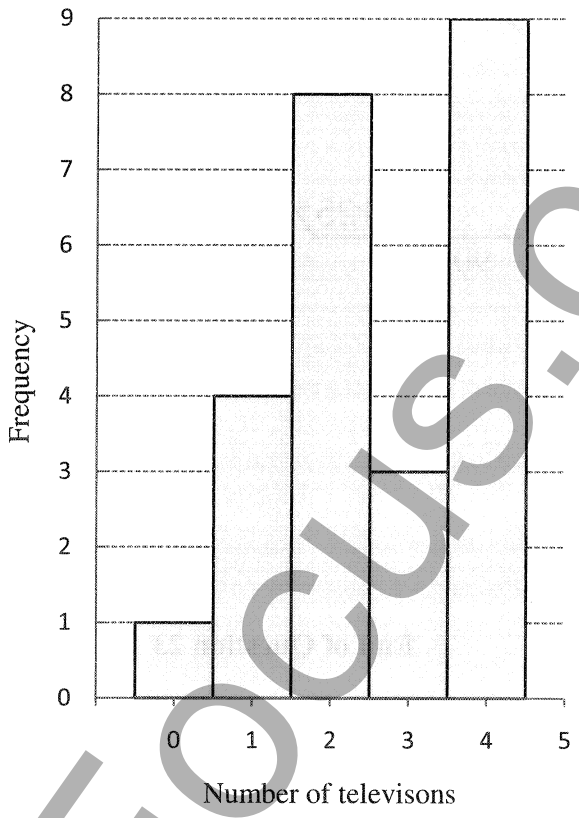
End of Question 23

Question 24 (13 marks) Use a SEPARATE writing booklet.

(a) Explain what is meant by the term "correlation coefficient". **1**

(b) A class of students was surveyed about the number of television sets in their home.

The frequency histogram displays their responses.



(i) What is the mode of this data? **1**

(ii) Find the mean for this data. **2**

(iii) The median for this set of data is 2. **1**

Natasha was absent on the day of the survey. On her return, she was surveyed and her response caused the median to increase.

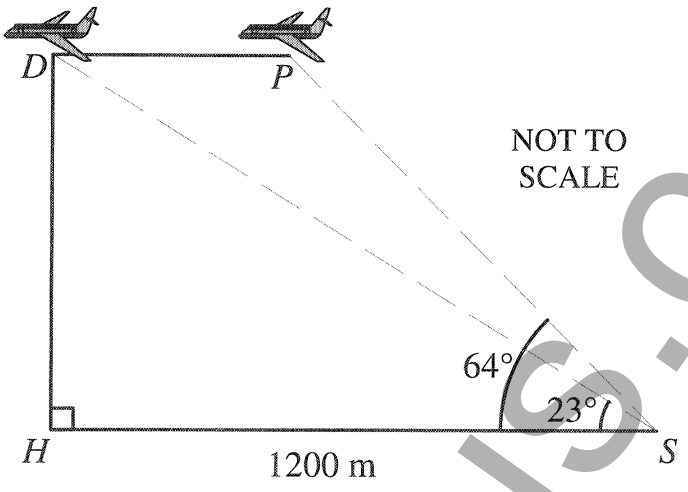
How many television sets could Natasha have? Briefly explain your answer.

Question 24 continues on Page 15

Question 24 (continued)

(c) Singha, *S*, is 1200 metres from his home, *H*, when he first sees an aeroplane. The angle of elevation from Singha to the plane at *P* is 64°. Five minutes later the plane is directly above Singha's home at *D*. The angle of elevation from Singha to *D* is 23°. **3**

How far did the aeroplane travel from *P* to *D*, to the nearest metre?



(d) Lucinda needs to buy a new refrigerator. She decides to buy the refrigerator on terms, as advertised below.

(i) Calculate the value of the deposit. **1**

(ii) How much does Lucinda pay for the refrigerator in total? **2**

(iii) Calculate the annual flat rate of interest that Lucinda paid, correct to ONE decimal place. **2**

End of Question 24

Question 25 (13 marks) Use a SEPARATE writing booklet.

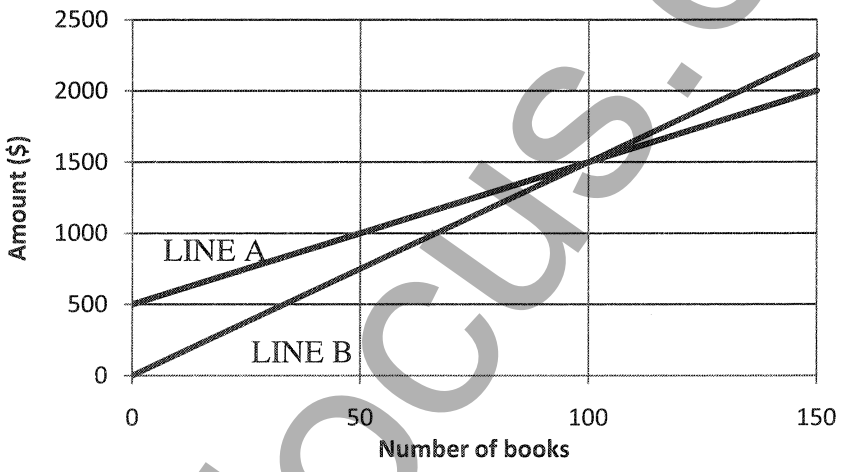
(a) Tina is saving to go to university in five years time. She invests $1500 per year into an account that earns 6% p.a. interest compounding yearly. **2**

How much money has Tina saved for university at the end of five years?

(b) Ravi has just written a new summary book to help his classmates and friends prepare for their HSC.

It initially cost him $500 to produce the book and a further $10 to print each copy. This cost (C), in dollars, can be represented by the equation $C = 500 + 10n$ where n is the number of books sold.

Ravi is hoping to sell the books for $15 each.



The graph above is a model that Ravi used to help him make decisions about the financial success of his project.

(i) What does LINE B on the graph represent? **1**

(ii) Explain the significance of the point where the two lines intersect. **1**

(iii) Using the graph, or otherwise, find the approximate loss if only 50 books are sold. **1**

(c) Lily has 200 ordinary shares in Watergex with a face value of $1.00. The shares have a market value of $4.34 and this year, Watergex paid a dividend of 32 cents per share. **1**

Calculate the dividend yield correct to ONE decimal place.

Question 25 continues on Page 17

(d) Before starting a fitness program, 16 people were asked to complete as many push-ups as possible in one minute. **3**

After six weeks in the fitness program the participants were again asked to complete as many push-ups as possible in one minute.

The results are displayed in the back-to-back stem-and-leaf plot below.

Number of Push-ups

Before		After
9 6 3 1	1	5
9 9 8 8 7 5 1	2	2 3
2 1 0 0	3	1 2 6 7 7
1	4	4 4 7 9 9
	5	0 8
	6	3

Compare and contrast the TWO sets of data by examining the shape and skewness of the distribution and the measures of location and spread.

(e) Ashleigh made up rules for a dice game as follows:

When a player rolls the die, the number on the top of the die determines whether the player collects money from Ashleigh or pays money to her.

Roll 1	Collect $10
Roll 2	Collect $5
Roll 3, 4, 5 or 6	Pay $3

(i) What is the probability of a player collecting money after the first roll of the die? **1**

(ii) Calculate the financial expectation of this game. **2**

(iii) Do you think this a good game for Ashleigh to play? Justify your answer. **1**

End of Question 25

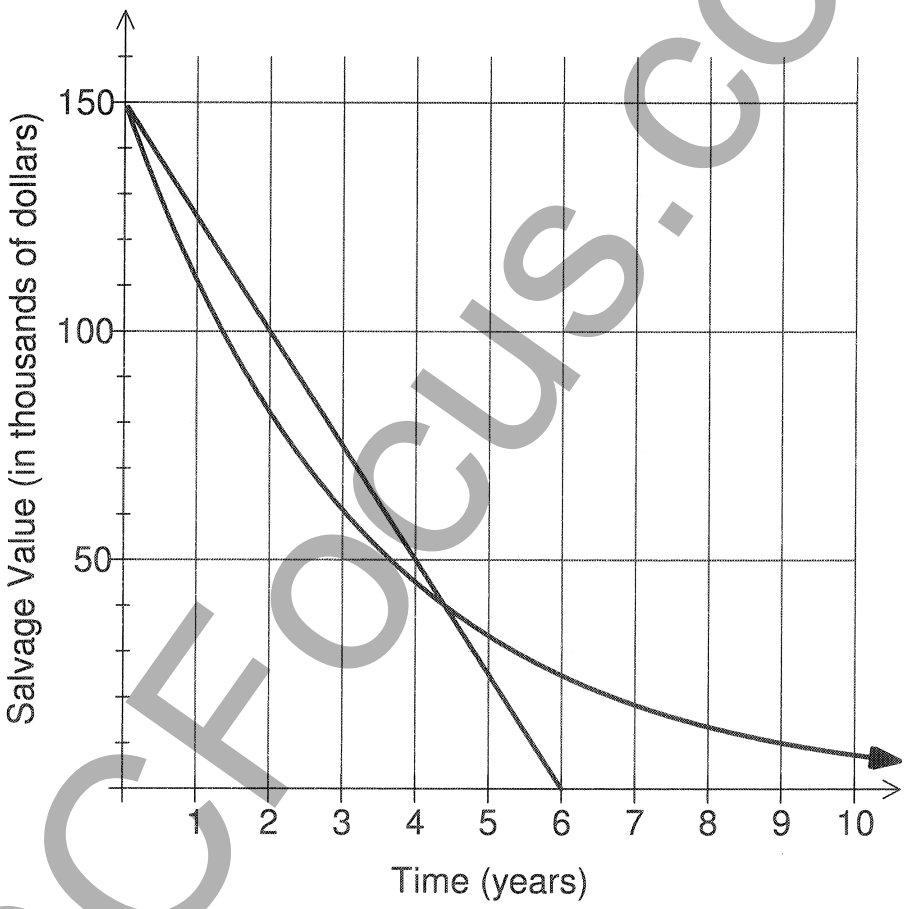
Question 26 (13 marks) Use a SEPARATE writing booklet.

(a) Expand and simplify $x(x+6)-3(4-x)$. **2**

(b) Oliver and Jane both purchase office equipment with an initial value of \$150 000.

Oliver uses the declining balance method to calculate the depreciation of his equipment. Jane uses the straight line method.

The graph below illustrates the depreciation of both Oliver's and Jane's equipment.



(i) After approximately how many years does the equipment have the same salvage value? **1**

(ii) What is the value of Oliver's office equipment after three years? **1**

(iii) Find, in dollars, the annual amount of depreciation for Jane's equipment. **1**

(iv) Using your answer in (iii), find the equation of the straight line. **1**

Question 26 continues on Page 19

(c) The weights of adult trout are normally distributed. The mean weight is 3.2 kg and the standard deviation is 0.6 kg.

(i) At a trout farm, 975 adult trout are caught over a weekend. **2**

How many of these trout would you expect to weigh more than 3.8 kg?

(ii) A fisherman is claiming to his friends that he caught an adult trout that weighed 6.5 kg. **1**

Use the information above to comment on the validity of the fisherman's claim.

(d) When a ball is rolled off a cliff the distance it falls, d metres, varies directly with the square of the time, t seconds, that it has been falling.

A ball was rolled off a cliff and after 5 seconds it had fallen 100 m.

(i) Using k as the constant of variation, write a formula for d in terms of t and k. **1**

(ii) Calculate the distance that the ball has fallen after eight seconds. **2**

(iii) If this cliff is 400 metres high, how long will it take the ball to reach the ground? **1**

End of Question 26

Question 27 (13 marks) Use a SEPARATE writing booklet.

(a) During one month 180 babies were born in a Sydney hospital.

Information regarding the weights and gender of these babies is shown in the two-way table below.

	Less than 4 kg	*4 kg or more*	*Total*
Boys	64	26	90
Girls	76	**A**	90
Total	**B**	40	180

(i) Find the values for **A** and **B**. 2

(ii) What fraction of the boys weighed less than 4 kg? 1

(iii) Comment on the accuracy of the following statement given the data above: 1

"Twice as many boys than girls born in Australia weigh 4 kg or more".

(b) Thomas and Charlie both have favourite board games which they play against each other.

Thomas has a 64% chance of winning his favourite game against Charlie.
Charlie has a 70% chance of winning his favourite game against Thomas.

(i) If they play Charlie's favourite game three times in a row, what is the probability that Thomas will win all three games? 2

(ii) To decide which game to play the boys toss a coin. If heads is thrown, Charlie's game is played. If tails is thrown, Thomas' game is played.

The boys toss a coin and play one game.

(1) Construct a probability tree diagram which displays the combinations of the game chosen and the winners. 2

(2) Hence, or otherwise, find the probability that Thomas wins the game played. 1

Question 27 continues on Page 21

Question 27 (continued)

(c) Fiona and Jordan have borrowed $300 000 to buy a house. The bank charges them interest of 12% p.a. compounding monthly. The term of the loan is 25 years to be repaid in equal monthly installments.

(i) Show that their monthly repayments are $3159.67. **2**

(ii) After 10 years Fiona and Jordan win the lottery and decide to pay off their loan. **2**

Calculate the amount needed from their lottery winnings to fully repay their loan.

End of Question 27

Question 28 (13 marks) Use a SEPARATE writing booklet.

(a) Fully simplify $3AP \div 6P^2$ 2

(b) Yatzu is planning to sail from Baker Island (0°, 176°W) to Nauru (0°, 166°E).

(i) Find the shortest distance between Baker Island and Nauru. 1

(ii) It takes Yatzu 48 hours to sail the shortest distance from Baker Island to Nauru. 2

If he leaves Baker Island at 8.00 am on Monday, what is the local time and day in Nauru on his arrival. (Ignore time zones)

(c) Jenny's block of land is an irregular shape as drawn below.

The block of land has an area of 11 070 m².

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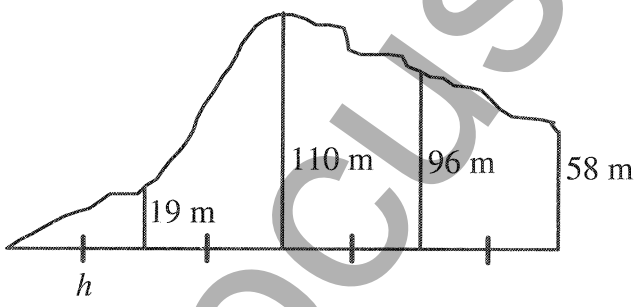


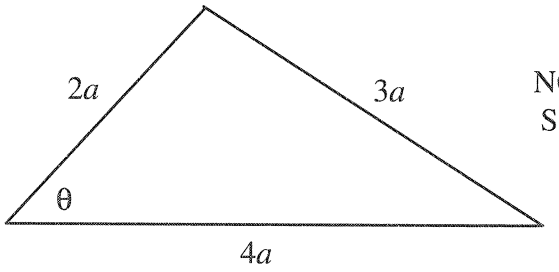
(i) Using TWO applications of Simpson's rule, write an equation for the area of Jenny's land. 2

(ii) By solving your equation, find the value of h. 2

Question 28 continues on Page 23

Question 28 (continued)

(d) A garden is constructed in the shape of a triangle as shown in the diagram below.



(i) Show that $\theta = 47°$. **2**

(ii) Write an algebraic expression for the area of the garden. **1**

(iii) If the value of a is doubled, by how much will the area change? **1**

End of paper

EXAMINERS

Tim Hildebrandt (Convenor)	Oakhill College, Castle Hill
Tennille Cummings	Oakhill College, Castle Hill
Patricia Davis	Wenona School, North Sydney
Julie Macri	St. Leo's Catholic College, Wahroonga