

HSC Trial Examination 2006

General Mathematics

This paper must be kept under strict security and may only be used on or after the morning of Tuesday 8 August, 2006 as specified in the Neap Examination Timetable.

General Instructions

Reading time 5 minutes.

Working time 2½ hours.

Write using black or blue pen.

Calculators may be used.

A formulae sheet is provided at the back of this paper.

Total marks – 100

Section I Pages 2–10
22 marks

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

Section II Pages 11–20
78 marks

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

Section I

Total 22 marks

Attempt Questions 1–22.

Allow about 30 minutes for this section.

Use the multiple-choice answer sheet.

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

correct
↓
A B C D

1. The normal price of a tin of paint is \$20. During a sale prices were reduced by 10%. As a regular customer, Paddy also receives an additional 5% discount off the discounted price. How much will Paddy have to pay for the tin of paint?

- (A) \$17.00
- (B) \$17.10
- (C) \$18.00
- (D) \$18.90

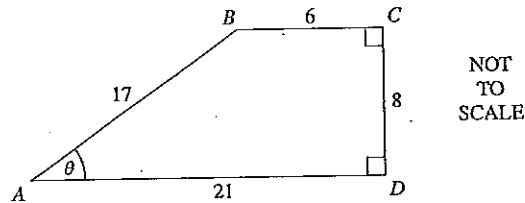
2. Simplify $\frac{20M^8}{4M^2}$.

- (A) $5M^4$
- (B) $5M^6$
- (C) $16M^4$
- (D) $16M^6$

3. Which of the following events is the most likely to happen?

- (A) Tossing a head with a coin.
- (B) Rolling a 4 with a normal die.
- (C) Correctly guessing the answer to a multiple-choice question with alternatives A, B, C and D.
- (D) Choosing a red jelly bean at random from a jar containing 5 red and 10 black jelly beans.

4.



In the diagram $ABCD$ is a trapezium. $\angle BCD = 90^\circ$, $\angle CDA = 90^\circ$,

$BC = 6$, $CD = 8$, $AD = 21$ and $\angle BAD = \theta$.

What is the value of $\tan \theta$?

- (A) $\frac{8}{15}$
- (B) $\frac{8}{17}$
- (C) $\frac{10}{17}$
- (D) $\frac{10}{21}$

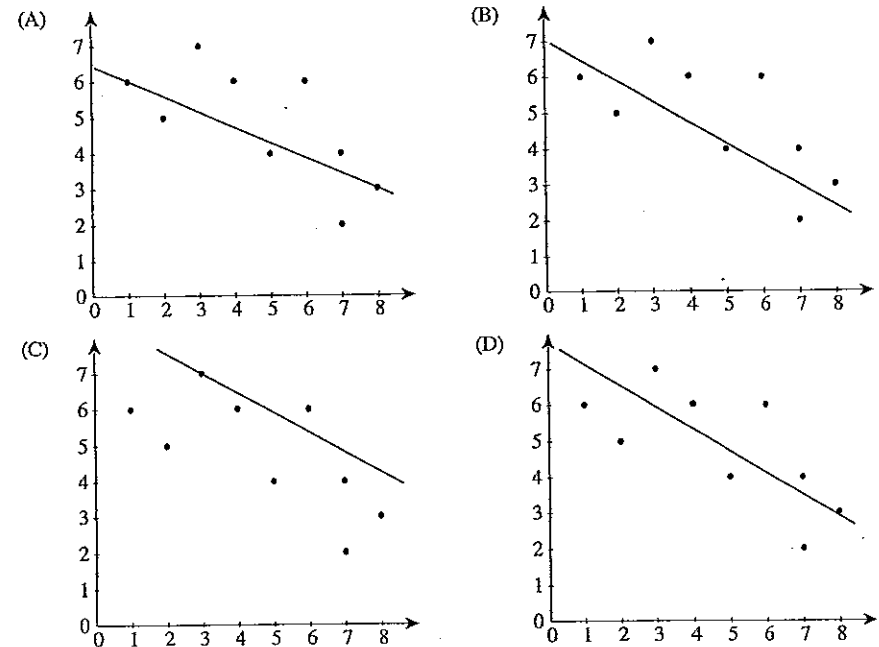
5. If x is the number of years required for an investment to double at 7% p.a. compound interest, then $(1.07)^x = 2$. Eva is trying to solve this equation by 'guess and check'. This table shows her progress.

The values Eva tried for x	20	5	12	7	9
The value of $(1.07)^x$ to 2 decimal places	3.87	1.40	2.25	1.61	1.84

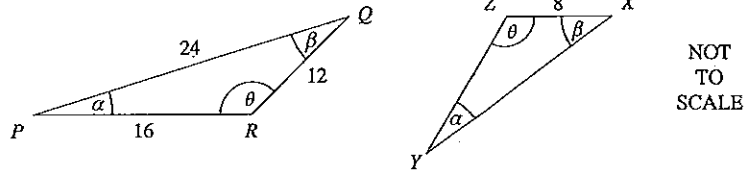
Eva's next try should be between which pair of numbers?

- (A) 5 and 7
- (B) 7 and 9
- (C) 9 and 12
- (D) 12 and 20

6. Which graph best shows the median regression line for the 9 points shown? (The 9 points are the same in each graph.)



7.

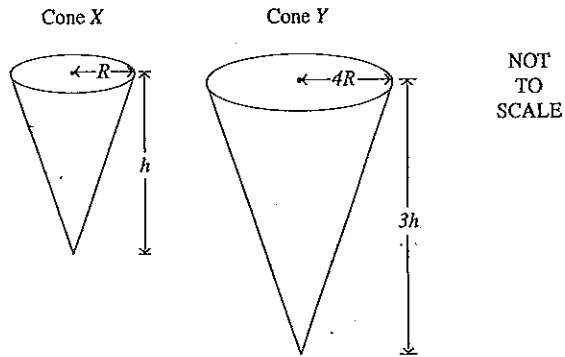


ΔPQR is an enlargement of ΔYZX .

What is the enlargement, or scale, factor?

- (A) $1\frac{1}{2}$
- (B) 2
- (C) 3
- (D) 8

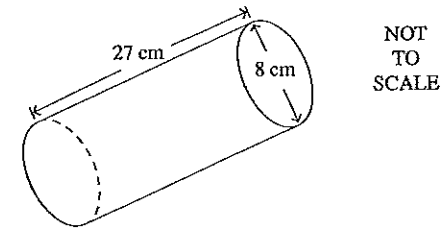
8.



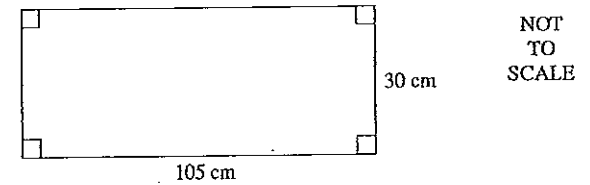
How many times bigger is the volume of cone Y than the volume of cone X?

- (A) 4
- (B) 12
- (C) 48
- (D) 144

9.



Duska is making cylindrical tubes by rolling up cardboard. The tubes have no ends. Duska has one sheet of cardboard 30 cm by 105 cm.



What is the maximum number of tubes Duska can make from the sheet of cardboard?

- (A) 3
- (B) 4
- (C) 5
- (D) 13

10. Meshel was charged an installation fee of $\$F$, and a monthly fee of $\$M$ for her satellite TV service. She calculated the total cost, $\$E$, of the installation and monthly fee for N months using the formula

$$E = M \times N + F.$$

In this formula, which pronumeral stands for the independent variable?

- (A) E
- (B) F
- (C) M
- (D) N

11. Make S the subject of the formula $V^2 = U^2 - 2aS$.

(A) $S = \frac{U^2 - V^2}{2a}$

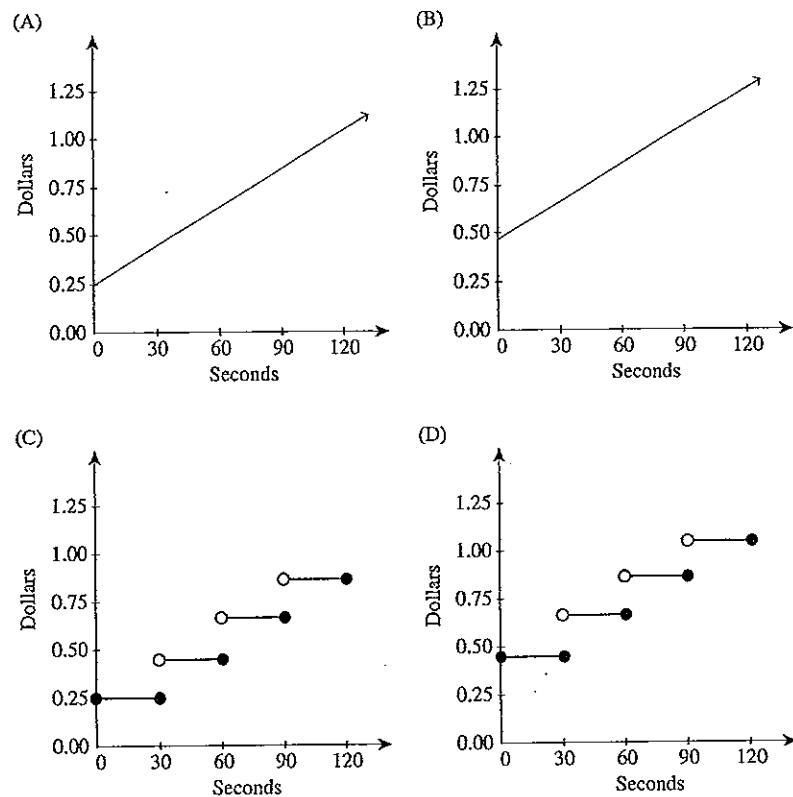
(B) $S = \frac{V^2 - U^2}{2a}$

(C) $S = U^2 - \frac{V^2}{2a}$

(D) $S = V^2 - \frac{U^2}{2a}$

12. Calls costs for Callum's mobile phone consist of a 25 cent connection fee plus 20 cents per 30 seconds or part thereof.

Which graph best displays the cost of Callum's mobile phone calls?



13. There are six students in a year 9 French class. On Monday, when Owen was absent from school, the other five students sat a listening test and obtained scores with a mean value of 12. After Owen completed the test the class's mean score became 11.

What was Owen's mark on the listening test?

- (A) 6
- (B) 8
- (C) 10
- (D) 11

14. The formula $C = \frac{5}{9}(F - 32)$ can be used to convert temperatures between degrees Celsius ($^{\circ}\text{C}$) and degrees Fahrenheit ($^{\circ}\text{F}$).

Which of the following temperatures is equivalent to 50°C ? Answer to the nearest whole degree.

- (A) 10°F
- (B) 60°F
- (C) 122°F
- (D) 148°F

15. Four sheep can eat all the grass in a 1-hectare paddock in 2 days. How many days will it take 5 sheep to eat all the grass in a similar 100-hectare paddock?

- (A) 40
- (B) 63
- (C) 80
- (D) 160

16. The scores of a sample of people are recorded in this table.

Score	Frequency
6	2
7	3
8	4
9	12
10	9
Total	30

Which of the following statements gives the correct median and distribution for the data listed above?

- (A) The median is 8 and the data is skewed.
- (B) The median is 8 and the data is normally distributed.
- (C) The median is 9 and the data is skewed.
- (D) The median is 9 and the data is normally distributed.

17. Peter is using the capture-recapture technique to estimate the number of fish in a dam.

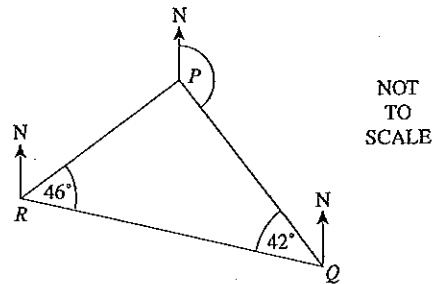
He took 200 fish out of the dam, tagged them, then put the fish back in the dam. Later, Peter caught 50 fish from the dam, 8 of which were tagged.

What is the approximate number of fish in the dam?

- (A) 242
- (B) 1250
- (C) 1600
- (D) 80 000

18. Seven properties are for sale in Berkley. The prices are:
\$305 000, \$305 000, \$316 000, \$320 000, \$325 000, \$330 000 and \$1.3 million.
Which statistical measure of these seven prices gives the best indication of the typical property price in Berkley?
(A) mean
(B) median
(C) mode
(D) range

19.



The diagram shows three towns, P , Q and R , and the direction of north from each town. $\angle PRQ = 46^\circ$ and $\angle RQP = 42^\circ$. The bearing from P to Q is 160° .

What is the bearing of R from P ?

- (A) 072°
(B) 206°
(C) 248°
(D) 252°
20. Narelle needs to give her horse a vitamin supplement at a rate of 20 grams per litre, in its water. The vitamin is available in a solution of 500 grams in 1 litre.
How much of the vitamin solution should Narelle add to the horse's 10 litres of water?
(A) 100 mL
(B) 250 mL
(C) 400 mL
(D) 5 L
21. Danny has two financial options:
Option 1: A 90% chance of gaining \$400
and a 10% chance of gaining \$200
Option 2: A 70% chance of gaining \$700
and a 30% chance of losing \$200
Which option has the greater financial expectation and by how much?
(A) Option 1 by \$90.
(B) Option 1 by \$100.
(C) Option 2 by \$50.
(D) Option 2 by \$170.

22.

Score	Frequency	Cumulative frequency
10	7	7
11	16	23
12	6	29
13	4	33

For this set of data, which pair of measures have the same value:
the lower quartile, upper quartile, median and mean?

- (A) The upper quartile and mean.
(B) The upper quartile and median.
(C) The lower quartile and mean.
(D) The lower quartile and median.

END OF SECTION I

Section II

Total marks 78

Attempt Questions 23–28.

Allow about 2 hours for this section.

Answer each question in a SEPARATE writing booklet.

All necessary working should be shown in every question.

Marks

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

- (a) Anika is making monthly repayments of \$99.40 for 2 years to repay a \$2000 loan. 2
How much interest will she pay?
- (b) Ian bought a painting at an American art auction. 1
The painting sold for \$US 800 plus 15% commission.
(i) Calculate the commission in \$US. 2
(ii) The conversion rate between Australian dollars and US dollars is \$A 1 = \$US 0.75. 2
Calculate the cost of the painting, including commission, in Australian dollars.
- (c) How much do you need to invest today at 6% p.a. annually compounding interest to have \$10 000 in 5 years time. 2
Express your answer correct to the nearest dollar.
- (d) Hamish receives a disability pension. The maximum pension is \$488.90 per fortnight, but for every dollar he earns over \$124 per fortnight, Hamish loses 40 cents from his pension. Hamish earns \$290 per fortnight. 2
Calculate the amount of pension Hamish can receive.

Question 23 continues on page 12

Marks

Question 23 (Continued)

- (e) Medical research workers have developed a new test for performance enhancing drugs. They are trialling the drug on members of the general community.

The results of the trial are shown in the table.

	<i>Test indicated drugs used</i>	<i>Test indicated drugs not used</i>	<i>Total</i>
<i>People who use drugs</i>	48	7	55
<i>People who don't use drugs</i>	5		
<i>Total</i>	53		120

- (i) Copy the table into your writing booklet and complete the three missing values. 2
- (ii) For what fraction of the people tested was the test result incorrect? 1
- (iii) For what percentage of the people who used the drugs did the test indicate that they didn't use drugs? 1

End of Question 23

Marks

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

- (a) When Mitchell borrowed \$80 000 at 7.2% p.a. monthly compounding interest over 10 years, his monthly repayments were \$937.13.

This table summarises his loan. All entries are correct to the nearest dollar.

Time	Total Mitchell has repaid	Total amount of interest Mitchell has paid	Balance still owing
End of the 1 st year	\$11 246	\$5575	\$74 330
End of the 2 nd year	\$22 491	\$10 729	\$68 237
End of the 3 rd year	X	\$15 428	\$61 692
End of the 4 th year	\$44 982	\$19 641	\$54 659
End of the 5 th year	\$56 228	\$23 330	\$47 102
End of the 6 th year	\$67 473	\$26 457	\$38 984
End of the 7 th year	\$78 719	\$28 980	Y
End of the 8 th year	\$89 964	\$30 854	\$20 889
End of the 9 th year	\$101 240	\$32 030	\$10 819
End of the 10 th year	\$112 455	\$32 456	\$0

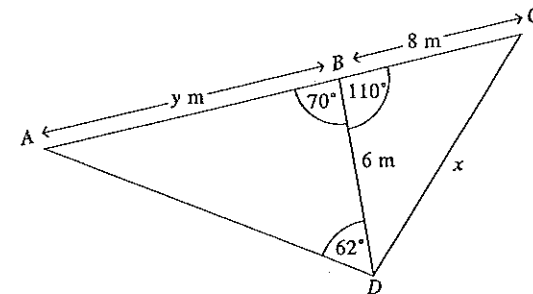
- (i) Show that Mitchell paid \$1176 interest during the 9th year. 1
- (ii) Why did he pay over \$5000 more interest in the first year than he did in the 9th year? 1
- (iii) Two values in the table are missing. What values should be in the positions marked X and Y? 2
- (iv) If interest rates increase and Mitchell leaves his repayments the same, describe how the values in the Balance still owing column will change and give a reason for your answer. 1
- (v) Is it true that even though the interest rate is only 7.2% p.a., almost 30% of Mitchell's repayments will be interest? Use a calculation to support your answer. 1
- (b) Diane invested \$1000 in monthly compounding interest. 2
- To calculate the amount her investment would grow to by the end of the investment she evaluated 1000×1.007^{48} .
- What was the annual rate of interest and the term of the loan?

Question 24 continues on page 14

Marks

Question 24 (Continued)

- (c)



NOT TO SCALE

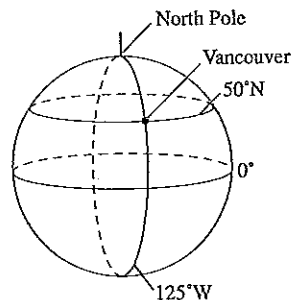
- (i) Determine the value of x and y in this diagram. 4
- (ii) Calculate the area of $\triangle DBC$. 1

End of Question 24

Marks

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

(a)



- (i) The position coordinates of Vancouver are 50°N , 125°W . 2

Calculate the distance from Vancouver to the North Pole in nautical miles.

- (ii) The latitude of the Canadian cities Vancouver and Winnipeg is 50° north and the difference in their longitudes is 30° . Winnipeg is east of Vancouver. 1

What are the position coordinates of Winnipeg?

- (iii) What time and day is it in Vancouver when it is 11 pm Monday in Winnipeg? 2

- (iv) The radius of the 50°N parallel of latitude is 4110 km. 2

Calculate the distance from Vancouver to Winnipeg along the 50°N small circle.

- (b) The probability that a biased coin shows a 'head' is 0.8.

- (i) What is the probability that the biased coin will show a 'tail'? 1

- (ii) David is going to toss the biased coin and a normal coin. 2

What is the probability that one or both of the coins will show 'heads'?

There are 24 coins in a bag. Some of the coins are biased and the remainder are normal. There are k biased coins in the bag.

- (iii) Write an expression involving k for the number of normal coins in the bag. 1

- (iv) When I choose a coin from the bag at random, I am twice as likely to choose a biased coin as I am to choose a normal coin. 2

Write an equation, and solve it, to determine the number of biased coins in the bag.

End of Question 25

Marks

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

- (a) People who fall into cold water often die. The length of time a typical Year 12 girl can survive in cold water can be modelled by the formula

$$S = 16 \times (1.13)^t$$

where S = the survival time in minutes and
 t = the temperature of the water in degrees centigrade ($^\circ\text{C}$).

- (i) Use the formula to determine the number of minutes a typical Year 12 girl will survive if she falls into water with temperature 0°C . 1

- (ii) Use the formula $S = 16 \times (1.13)^t$ to determine the missing value in the table. 1

Temperature, t	4	10	16	21	27
Survival time, S	26		113	208	433

- (iii) Draw a graph that shows the survival time in minutes of a typical Year 12 girl in cold water. Show values from 0°C to 27°C on the horizontal axis. Label the axes and the scales carefully. 4

- (iv) Which term best describes this model: cubic, exponential, hyperbolic, linear or parabolic? 1

- (v) Kirrily is a typical Year 12 girl. She was rescued, alive, after she spent 80 minutes in cold water. 1

Use the graph you constructed in part iii to determine the minimum temperature the water could have been.

- (vi) Explain any limitations of this model. 1

- (vii) If a person in cold water tries to swim or tread water, their survival time decreases by 50%. 1

On the graph you constructed in part iii, show a second graph to illustrate the survival time of a typical Year 12 girl in cold water if she tries to swim or tread water. Label the graphs carefully.

- (b) The number of minutes, T , a person can survive in water with a temperature of 4°C is directly proportional to the square of their mass, M , i.e. $T \propto M^2$. A 60 kg person can survive for 30 minutes in water at 4°C . 3

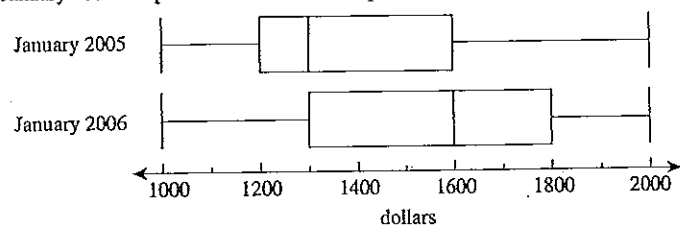
How long can a 30 kg child survive in water the same temperature?

End of Question 26

Marks

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

- (a) John owns a muffin business. He displayed the daily total sales for January 2005 and January 2006 in a pair of box-and-whiskers plots.



- (i) Compare and contrast the daily sales in January 2005 and January 2006. 2
- (ii) John worked 28 days in January. Estimate his total sales for the month in 2006. Show a calculation to justify your estimate. 1

- (b) The mean weight of golden retriever dogs is 34 kg and the standard deviation is 5 kg.

- (i) The recommended weight for golden retrievers is 24 to 34 kg. 2

What percentage of golden retrievers are in the recommended weight range?

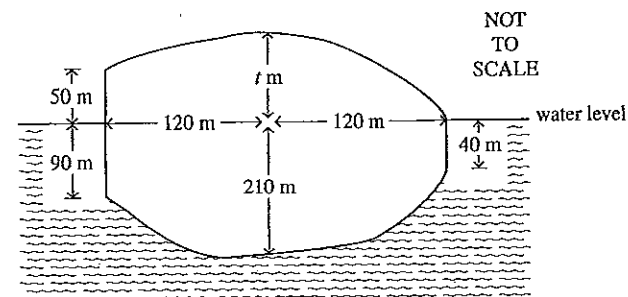
- (ii) Honey is a golden retriever and her weight has a z-score of 2. How many kilograms does she need to loose to lie within the healthy weight range? 2

Question 27 continues on page 18

Marks

Question 27 (Continued)

- (c)



The diagram shows the cross-section of an iceberg. The area of the cross-section is $52\,000\text{ m}^2$.

- (i) Use two applications of Simpson's Rule to determine the approximate height, t metres, of the top of the iceberg above the water. 3
- (ii) The iceberg is in the shape of a regular solid, 500 metres long. 1
- Calculate the volume of ice in the iceberg in cubic metres.
- (iii) When water freezes to become ice the volume increases by 9%. 2

Determine the number of cubic metres of water that froze to make the iceberg. Express your answer in scientific notation correct to 2 significant figures.

End of Question 27

Marks

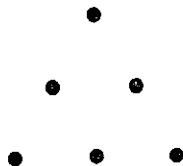
Question 28 (13 marks) Use a SEPARATE writing booklet.

- (a) Jo is using straight line depreciation to calculate the depreciated value of her business machinery.

<i>New value</i>	\$70 000
<i>Value at 3 years old</i>	\$28 000

- (i) What is the value of the taxation deduction Jo has been able to claim for depreciation each year? 1
- (ii) Calculate the annual rate of straight line depreciation Jo is using. 1
- (iii) Calculate the salvage value of the machinery when it is 3 years old if Jo was depreciating it at 25% p.a. with the declining balance method of depreciation. 2
- (iv) If Jo had chosen to use declining balance depreciation at the rate of 25% p.a. how much could she have claimed off her tax for depreciation in the third year? 2

- (b) Imran is conducting a psychology experiment. He arranged six lights in an equilateral triangle pattern.



He asks his subjects to select 3 lights and turn them on.

- (i) Show that there are 20 different ways the subjects can choose three lights out of the six lights. 2
- (ii) How many different equilateral triangles can be made from 3 lights in the pattern? 1
- (iii) Imran recorded whether the pattern made by the lights the subject turned on made an equilateral triangle. 1

<i>Lights made an equilateral triangle</i>	30
<i>Lights didn't make an equilateral triangle</i>	50

What is the experimental probability that Imran's subjects will choose to turn on lights that make an equilateral triangle?

Question 28 continues on page 20

Marks

Question 28 (Continued)

- (iv) Imran's conclusion:

3

"When I ask people to turn on three lights, they don't choose the lights at random."

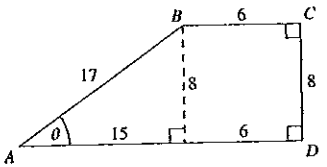
Do you agree with Imran's conclusion? Support your answer with a calculation of the theoretical probability that three randomly selected lights in the pattern will form an equilateral triangle.

END OF PAPER

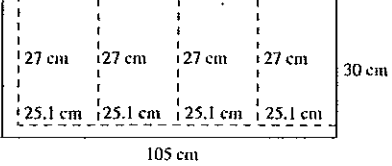
General Mathematics

Solutions and marking guidelines

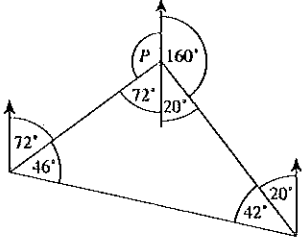
Section 1

	Answer and explanation	Outcomes assessed	Content area assessed
Question 1	B Discount = $\frac{10}{100} \times \$20$ = \$2 Sale price = \$18 Extra discount = $\frac{5}{100} \times \$18$ = \$0.90 Final price = \$17.10	M1	P2
Question 2	B $\frac{20}{4} \times M^{8-2} = 5M^6$	AM1	P2
Question 3	A The probabilities are $\frac{1}{2}$, $\frac{1}{6}$, $\frac{1}{4}$ and $\frac{5}{15}$. The first probability is the largest.	PB2	P10
Question 4	A  $\frac{\text{opposite}}{\text{adjacent}} = \frac{8}{15}$	M4	P6
Question 5	C 2 is between 1.84 and 2.25. She should choose a number between 9 and 12.	AM3	H7, H11
Question 6	D The three median points are (2, 6), (5, 6) and (7, 3). Draw a line parallel to the line joining (2, 6) and (7, 3) and moved $\frac{1}{3}$ of the distance towards (5, 6).	DA7	H9
Question 7	A 12 matches with 8 as they are both opposite $\angle \alpha$. Enlargement factor = $\frac{12}{8}$ = $1\frac{1}{2}$	M3	P6

Section I (Continued)

Question	Answer and explanation	Outcomes assessed	Content area assessed
Question 8	C Cone X: $V = \frac{1}{3}\pi R^2 h$ Cone Y: $V = \frac{1}{3}\pi(4R)^2 \times (3h)$ $= \frac{1}{3}\pi \times 48R^2 h$	M2	P6
Question 9	B Each roll requires cardboard 27 cm by $\pi \times 8 = 25.1$ cm, i.e. 27 cm by 25.1 cm. 	M5	H6, H7
Question 10	D N is the independent variable.	AM2	P3, P4, P5
Question 11	A $V^2 = U^2 - 2aS$ $2aS + V^2 = U^2$ $2aS = U^2 - V^2$ $S = \frac{U^2 - V^2}{2a}$	AM3	H3
Question 12	D 'Part thereof' requires a step graph. The initial value is $25c + 20c = 45c$.	AM2	P5
Question 13	A Five students marks add to $5 \times 12 = 60$. Six students marks add to $6 \times 11 = 66$. Owen's mark is $66 - 60 = 6$.	DA4	P2
Question 14	C $50 \times 9 = 5(F - 32)$ $450 = 5F - 160$ $610 = 5F$ $F = 122$ OR Using the equation solver in a graphics calculator, $F = 122$.	AM1	P7

Section I (Continued)

Question	Answer and explanation	Outcomes assessed	Content area assessed
Question 15	D 1 sheep will take 8 days to eat 1 hectare. 1 sheep will take 800 days to eat 100 hectares. 5 sheep will take $800 \div 5 = 160$ days to eat 100 hectares.	M1	P5, P7
Question 16	C Median is $15\frac{1}{2}$ th score = 9 Scores are not symmetrical. Distribution is skewed.	DA6	H9
Question 17	B The probability of a fish being tagged is $\frac{8}{50}$. There are 200 tagged fish. Number of fish = $200 \div \frac{8}{50}$ $= 1250$	PB4	H10
Question 18	B Mode gives the smallest value. Mean is significantly affected by the value of 1.3 million. Range is irrelevant. Median gives the middle score – the most appropriate in this case.	DA4	P2
Question 19	D 	M6	H6
Question 20	C Horse requires 20 grams per litre. For 10 litres it needs 20×10 grams. Horse requires 200 grams. 1 litre of solution provides 500 grams. Need two-fifths of a litre, i.e. 400 mL.	M1	P5, P7
Question 21	C Option 1: $0.9 \times \$400 + 0.1 \times \$200 = \$380$. Option 2: $0.7 \times \$700 - 0.3 \times \$200 = \$430$. Option 2 is better by $\$430 - \$380 = \$50$.	PB4	H4, H10

Section I (Continued)

Answer and explanation	Outcomes assessed	Content area assessed
<p>Question 22 D</p> <p>Lower quartile = 11</p> <p>Median = 11</p> <p>Upper quartile = 12</p> <p>Mean = 11.21</p> <p>Lower quartile and the median are the same.</p>	DA3	H9

Section II

Codes used in these answers:

CFPA means accept answer calculated Correct from Previous Answer.

ISE means ignore Subsequent Error.

CNE means Correct Numerical Expression.

The only TE (Transcription Error) allowed is from the exam paper to the answer paper.

Question 23

Sample answer	Syllabus outcomes and marking guide
<p>(a) Total paid = $24 \times \\$99.40$ $= \\$2385.60$ Interest = $\\$385.60$</p>	<p>FM4, H8</p> <ul style="list-style-type: none"> • Correct answer 2 • Correctly states total paid OR • Calculates interest from an incorrect total paid 1
<p>(b) (i) Commission = $\frac{15}{100} \times \\$US800$ $= \\$US120$</p> <p>(ii) Cost in \$US = $\\$920$ $\\$US920 = \frac{\\$A920}{0.75}$ $= \\$A1226.67$</p>	<p>FM1, P8</p> <ul style="list-style-type: none"> • Correct answer (ignore units) 1 <p>MI, P2</p> <ul style="list-style-type: none"> • Correct answer, ignore rounding. Accept answer correct from previous answer 2 • Incorrect amount changed to \$A correctly (ignore units) 1
<p>(c) Amount = $\frac{10\ 000}{1.06^5}$ $= \\$7472.58$ $= \\$7473$ to the nearest dollar</p> <p>OR</p> <p>Using a graphics calculator: $n = 5$ $I\% = 6$ $PV = (\text{anything})$ $PMT = 0$ $FV = 10\ 000$ $P/Y = 1$ $C/Y = 1$</p>	<p>FM5, H5, H8</p> <ul style="list-style-type: none"> • Correct answer, correctly rounded to the nearest dollar 2 • Correct numerical expression OR • Incorrect answer with correct rounding shown 1
<p>(d) Amount earned over \$124 per fortnight = $\\$166$ Amount of lost pension = $\\$166 \times 0.40$ $= \\$66.40$ Hamish's pension = $\\$488.90 - \\66.40 $= \\$422.50$</p>	<p>FM1, P2, P8</p> <ul style="list-style-type: none"> • Correct answer 2 • Calculation of $\\$66.40$ OR • An incorrect calculation in place of $\\$66.40$ subtracted from $\\$488.90$ 1

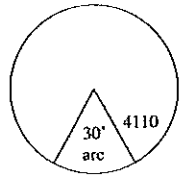
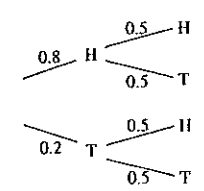
Question 23 (Continued)

Sample answer				Syllabus outcomes and marking guide
(e) (i)				
	<i>Test, drugs used</i>	<i>Test, drugs not used</i>	<i>Total</i>	
<i>Use drugs</i>	48	7	55	
<i>Don't use drugs</i>	5	60	65	
<i>Total</i>	53	67	120	
(ii)	$\frac{12}{120}$ OR $\frac{1}{10}$			PB4, H4 • Correct answer (ISE) 1
(iii)	$\frac{7}{55} \times 100 = 12.7\%$			PB4, H4 • Correct answer 1

Question 24

Sample answer		Syllabus outcomes and marking guide
(a) (i)	$\$32\,030 - \$30\,854 = \$1176$	
(ii)	He pays interest on the amount he owes. The more he owes the more interest he pays. He owes more in the first year than he does in the 9th year.	FM4, H11 • Correct explanation 1
(iii)	$X: \$937.13 \times 36 = \$33\,736.68$ OR $\$33\,737$ $Y: \text{Owing} = \$80\,000 - (\text{repayments} - \text{interest})$ $= \$80\,000 - (\$78\,719 - \$28\,980)$ $= \$30\,261$	FM4, H2, H5 • Both values for X and Y correct (ignore rounding) 2 • Either value for X or Y correct 1
(iv)	They will be larger because a larger amount of his repayments will be interest, so a smaller amount will come off the amount still owing.	FM4, H11 • Correct explanation 1
(v)	Total interest = \$32 456 Total repaid = \$112 455 $\frac{\text{interest}}{\text{total amount}} = \frac{32456}{112455} \times 100$ $= 28.861\%$ It is true as 28.861% is nearly 30%.	FM4, H11 • Correct conclusion with calculation supporting answer 1
(b)	Term of loan = $48 + 12$ $= 4$ years Annual rate of interest = 0.007×12 $= 0.084$ $= 8.4\%$	FM2, P8 • Correct term of loan (4 years or 48 months) AND • Correct annual rate of interest (8.4%) ... 2 • Correct term of loan (4 years or 48 months) OR • Correct annual rate of interest (8.4%) ... 1
(c) (i)	$x^2 = 6^2 + 8^2 - 2 \times 6 \times 8 \times \cos 110^\circ$ $x = 11.52...$ The third angle in $\triangle ABD$ is 48° . $\frac{y}{\sin 62} = \frac{6}{\sin 48}$ $y = 7.1287$	M6, H6 • Both x and y correct (ignore rounding) ... 4 • One value of x or y correct AND • Correct substitution into formula for the other variable 3 • One value of x or y correct OR • Correct substitution into formulas for both x and y 2 • Correct substitution into a formula for either x or y 1
(ii)	Area = $\frac{1}{2} \times 8 \times 6 \times \sin 110^\circ$ $= 22.55$	M6, H6 • Correct substitution into correct formula (ISE) 1

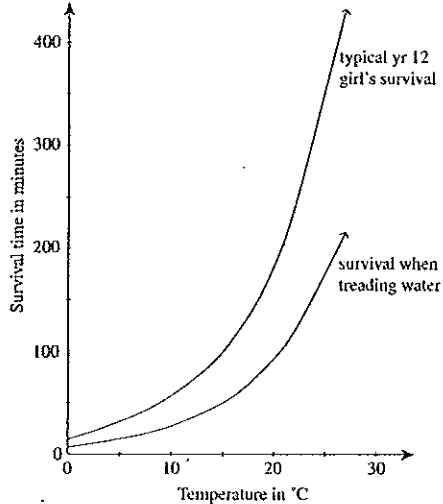
Question 25

Sample answer	Syllabus outcomes and marking guide
(a) (i) Angular distance from Vancouver to North Pole $= 90^\circ - 50^\circ$ $= 40^\circ$ Distance $= 40^\circ \times 60$ nautical miles $= 2400$ nautical miles	M7, H6 • Correct distance in nautical miles 2 • Correct distance in kilometres OR • Correct angular distance OR • Incorrect angular distance used in an otherwise correct method. 1
(ii) Winnipeg is $(50^\circ\text{N}, 95^\circ\text{W})$.	M7, H6 • Correct answer 1
(iii) Time difference $= 30 \times 4$ minutes $= 120$ minutes or 2 hours Vancouver is behind Winnipeg. Vancouver time $= 11\text{pm} - 2$ hours $= 9\text{pm}$ on the same day $= 9\text{pm}$ Monday	M7, H6, H7 • Correct time and day 2 • Calculation of a two hour time difference OR • Correct time and day from their time difference 1
(iv)  $\text{Arc length} = \frac{30}{360} \times 2 \times \pi \times 4110 \text{ km}$ $= 2151.99\dots \text{ or } 2152 \text{ km}$	M7, H6 • Correct answer, ignore rounding 2 • Calculation of the circumference of the circle OR • determining the required fraction 1
(b) (i) $P(T) = 1 - 0.8$ $= 0.2$	PB2, P10 • Correct expression: $1 - 0.8$ or 0.2 1
(ii) Biased Normal  $\text{Probability} = HH + HT + TH$ $= 0.8 \times 0.5 + 0.8 \times 0.5 + 0.2 \times 0.5$ $= 0.9$	PB3, H10 • Correct answer OR • Correct from previous answer 2 • Significant attempt to use a tree diagram or other systematic method. 1
(iii) Number of normal coins $= 24 - k$	AM1, P3 • Correct answer 1

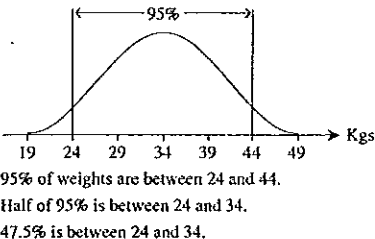
Question 25 (Continued)

Sample answer	Syllabus outcomes and marking guide
(iv) $2 \times (24 - k) = k$ $k = 16$	AM1, P3 • Correct equation in any form AND • correct value of k 2 • Correct value of k , by inspection OR • Correct equation in any form OR • Correct solution to a non-trivial, relevant equation 1

Question 26

Sample answer	Syllabus outcomes and marking guide
(a) (i) $16 \times (1.13)^0 = 16$ minutes	AM4, H2 • Correct answer 1
(ii) $16 \times (1.13)^{10} = 54.313$	AM4, H2 • Correct answer, ignore rounding 1
(iii) 	AM4, H3 • Smooth, exponential curve through correct points AND • Labelled axes with appropriate scale 4 • An essentially correct graph missing one of the features required for 4 marks. A maximum of 2 marks if the curve is not smooth 3 • Any two of the features required for 1 mark 2 • One axis labelled correctly OR • One appropriate axis scale OR • Points plotted correctly 1
(iv) Exponential	AM4, H3 • Correct answer 1
(v) From the graph 13°	AM4, H5 • Correct answer, accept answer correct from their graph in part iii 1
(vi) It is only relevant for low temperatures above zero. For example, people cannot last very long in hot water and water colder than 0°C is ice.	AM4, H11 • Any correct limitation 1
(vii) Answer on the graph.	AM4, H5, H11 • Appropriate graph from their previous graph. AND • Graph must be clearly distinguishable from graph in part iii. 1
(b) $T = kM^2$ $30 = k \times 60^2$ $k = 0.00833$ $T = 0.00833 \times 30^2$ $T = 7.5$ minutes to 1 decimal place	AM4, H5 • Correct answer, ignoring rounding 3 • Significant progress in solution, e.g. the value of k 2 • Use of the equation $T = kM^2$ 1

Question 27

Sample answer	Syllabus outcomes and marking guide																		
(a) (i) <table border="1" data-bbox="1294 252 1736 518"> <thead> <tr> <th></th> <th>January 05</th> <th>January 06</th> </tr> </thead> <tbody> <tr> <td>Lowest amount</td> <td>\$1000</td> <td>\$1000</td> </tr> <tr> <td>Lower quartile</td> <td>\$1200</td> <td>\$1300</td> </tr> <tr> <td>Median</td> <td>\$1300</td> <td>\$1600</td> </tr> <tr> <td>Upper quartile</td> <td>\$1600</td> <td>\$1800</td> </tr> <tr> <td>Largest amount</td> <td>\$2000</td> <td>\$2000</td> </tr> </tbody> </table>		January 05	January 06	Lowest amount	\$1000	\$1000	Lower quartile	\$1200	\$1300	Median	\$1300	\$1600	Upper quartile	\$1600	\$1800	Largest amount	\$2000	\$2000	DA5, H14 • All 5 values correct 2 • At least 3 values correct 1
	January 05	January 06																	
Lowest amount	\$1000	\$1000																	
Lower quartile	\$1200	\$1300																	
Median	\$1300	\$1600																	
Upper quartile	\$1600	\$1800																	
Largest amount	\$2000	\$2000																	
(ii) Many strategies possible, e.g. $28 \times \$1600 = \$44\ 800$ OR $7 \times \$1900 + 7 \times \$1700 + 7 \times \$1450 + 7 \times \$1150 = \$43\ 400$	DA5, H5, H9, H11 • Accept a value from \$43 000 to \$44 800, with appropriate working 1																		
(b) (i) 	DA6, H9 • Correct answer 2 • Demonstrates appropriate percentages with reference to a normal curve 1																		
(ii) $2 = \frac{x - 34}{5}$ $x = 44$ kg She needs to loose at least 10 kg.	DA6, H4, H5, H9 • $x = 44$ kg with correct conclusion 2 • $x = 44$ kg with no, or wrong, conclusion OR • correct substitution into the z-score formula 1																		
(c) (i) $\frac{120}{3} \times (50 + 4t + 0) + \frac{120}{3} \times (90 + 4 \times 210 + 40)$ $= 52\ 000$ $t = 70$ m	M5, H6 • Correct answer 3 • Correct equation linking 2 applications of Simpson's rule 2 • Correct substitution into Simpson's rule for one application. 1																		
(ii) $V = 500 \times 52\ 000$ $= 26\ 000\ 000$ m ³	M5, H6 • Correct answer 1																		

Question 27	(Continued) Sample answer	Syllabus outcomes and marking guide
(iii)	$109\% = 26\,000\,000$ $1\% = 238\,532.11$ $100\% = 2.4 \times 10^7 \text{m}^3$	M1, P5, P7 <ul style="list-style-type: none"> • Correct answer in scientific notation, to two significant figures. 2 • Correct answer not expressed with correct scientific notation OR • Incorrect answer expressed with correct scientific notation, to two significant figures 1

Question 28	Sample answer	Syllabus outcomes and marking guide
(a) (i)	Total depreciation = $\$70\,000 - \$28\,000$ $= \$42\,000$ Each year she can claim $\frac{\$42\,000}{3} = \$14\,000$	FM6, H8, H5 <ul style="list-style-type: none"> • Correct answer. 1
(ii)	$\frac{14\,000}{70\,000} \times 100 = 20\%$	FM6, H8, H5 <ul style="list-style-type: none"> • Correct answer. 1
(iii)	Value = $70\,000(1 - 0.25)^3$ $= \$29\,531.25$	FM6, H5, H8 <ul style="list-style-type: none"> • Correct answer. 2 • Correct substitution into the correct formula. 1
(iv)	Value at the end of the 2nd year $= 70\,000(1 - 0.25)^2$ $= \$39\,375$ Depreciation in 3rd year $= \$39\,375 - \$29\,531.25$ $= \$9843.75$ She can claim $\$9843.75$ in depreciation off her tax	FM6, H5, H6 <ul style="list-style-type: none"> • Correct answer. 2 • Use of the concept that the depreciation is the difference between the salvage value for consecutive years. 1
(b) (i)	${}^6C_3 = 20$ OR Call the lights <i>A, B, C, D, E</i> and <i>F</i> . <i>ABC, ABD, ABE, ABF, ACD, ACE, ACF</i> <i>ADE, ADF, AEF, BCD, BCE, BCF, BDE,</i> <i>BDF, BEF, CDE, CDF, CEF, DEF</i>	PB3, H10 <ul style="list-style-type: none"> • Correct demonstration. 2 • Attempt to list the possibilities systematically. 1
(ii)	5 (4 small and 1 big)	PB3, H10 <ul style="list-style-type: none"> • Correct answer. 1
(iii)	Experimental probability = $\frac{30}{80} = \frac{3}{8}$	PB2, P10 <ul style="list-style-type: none"> • Correct value, accept non-simplified. 1
(iv)	Theoretical probability = $\frac{5}{20} = \frac{1}{4}$ If 80 people selected at random only $\frac{1}{4} \times 80$, or 20 people should have selected lights in an equilateral triangle pattern. As 50% more than the number expected for choosing at random selected lights in an equilateral triangle pattern, the people aren't choosing at random. Imran's conclusion is correct.	PB4, H10, H11 <ul style="list-style-type: none"> • Complete answer including theoretical probability, expected number, and a discussion of the concept of randomness as relevant to this context. (Accept use of an incorrect experimental value from their answer to parts ii or iii.) 3 • Makes substantial progress in answering the question 2 • Makes some progress, e.g. calculates theoretical probability OR • Discusses randomness OR • Calculates a theoretical expected number. 1

Formulae Sheet

Area of an annulus

$$A = \pi(R^2 - r^2)$$

R = radius of outer circle

r = radius of inner circle

Area of an ellipse

$$A = \pi ab$$

a = length of semi-major axis

b = length of semi-minor axis

Area of a sector

$$A = \frac{\theta}{360} \pi r^2$$

θ = number of degrees in central angle

Arc length of a circle

$$l = \frac{\theta}{360} 2\pi r$$

θ = number of degrees in central angle

Simpson's rule for area approximation

$$A \approx \frac{h}{3} (d_f + 4d_m + d_l)$$

h = distance between successive measurements

d_f = first measurement

d_m = middle measurement

d_l = last measurement

Surface area

Sphere:

$$A = 4\pi r^2$$

Closed cylinder:

$$A = 2\pi r h + 2\pi r^2$$

r = radius

h = perpendicular height

Volume

Cone:

$$V = \frac{1}{3} \pi r^2 h$$

Cylinder:

$$V = \pi r^2 h$$

Pyramid:

$$V = \frac{1}{3} Ah$$

Sphere:

$$V = \frac{4}{3} \pi r^3$$

r = radius

h = perpendicular height

A = area of base

Sine rule

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

Area of a triangle

$$A = \frac{1}{2} ab \sin C$$

Cosine rule

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

OR

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Simple interest

$$I = Prn$$

- P = initial quantity
- r = percentage interest rate per period, expressed as a decimal
- n = number of periods

Compound interest

$$A = P(1 + r)^n$$

- A = final balance
- P = initial quantity
- n = number of compounding periods
- r = percentage interest rate per compounding period, expressed as a decimal

Future value (A) of an annuity

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

- M = contribution per period, paid at the end of the period

Present value (N) of an annuity

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

OR

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

Straight-line formula for depreciation

$$S = V_0 - Dn$$

- S = salvage value of asset after n periods
- V_0 = purchase price of the asset
- D = amount of depreciation apportioned per period
- n = number of periods

Declining balance formula for depreciation

$$S = V_0(1 - r)^n$$

- S = salvage value of asset after n periods
- r = percentage interest rate per period, expressed as a decimal

Mean of a sample

$$\bar{x} = \frac{\sum x}{n}$$

OR

$$\bar{x} = \frac{\sum fx}{\sum f}$$

- \bar{x} = mean
- x = individual score
- n = number of scores
- f = frequency

Formula for a z-score

$$z = \frac{x - \bar{x}}{s}$$

- s = standard deviation

Gradient of a straight line

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient–intercept form of straight line

$$y = mx + b$$

- m = gradient
- b = y -intercept

Probability of an event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$