

Neap:

HSC Trial Examination 2007

General Mathematics

This paper must be kept under strict security and may only be used on or after the morning of Monday 13 August, 2007 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

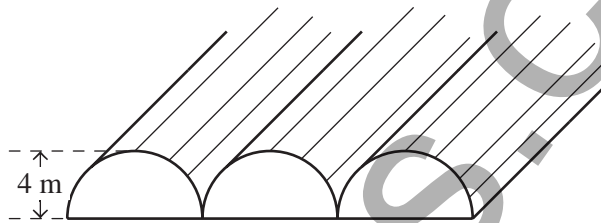
Allow about 2 hours for this section

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- The mass of a 20c coin is 8 grams. Lucy's piggy bank contains only 20c coins and the mass of the contents of the piggy bank is 12 kg. Calculate the value of the coins in Lucy's piggy bank.
 - \$30
 - \$75
 - \$300
 - \$750
- One nautical mile is 1852 metres. Convert 9 km into nautical miles (M), correct to 1 decimal place.
 - 1.7 M
 - 4.9 M
 - 16.7 M
 - 48.6 M

3.



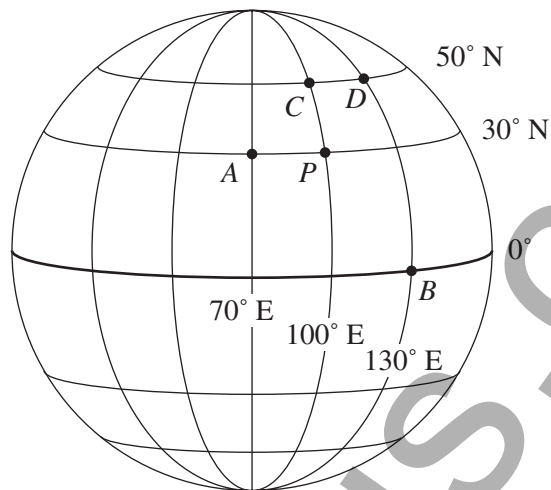
The tunnel under the English Channel connects France and England. The tunnel is 50 km long and it is made of three half cylinders, as in the diagram. The height of the half cylinders is 4 metres.

Assuming that the tunnel is empty, calculate the volume of air in the tunnel.

- $1.3 \times 10^6 \text{ m}^3$
 - $1.5 \times 10^7 \text{ m}^3$
 - $1.7 \times 10^6 \text{ m}^3$
 - $3.8 \times 10^6 \text{ m}^3$
- Two rescue groups left their headquarters, H , to search for a lost bushwalker. Both groups walked in a straight line. One group walked for 5 km in the direction 062° . The other walked for 7 km in the direction 132° . Which diagram correctly shows this information?
 -
 -
 -
 -

5. Huang recorded the length of a piece of wood as 160 cm, correct to the nearest centimetre. What is the maximum percentage error involved in Huang's measurement?
- (A) 3.2%
 (B) 3.125%
 (C) 0.32%
 (D) 0.3125%

6.

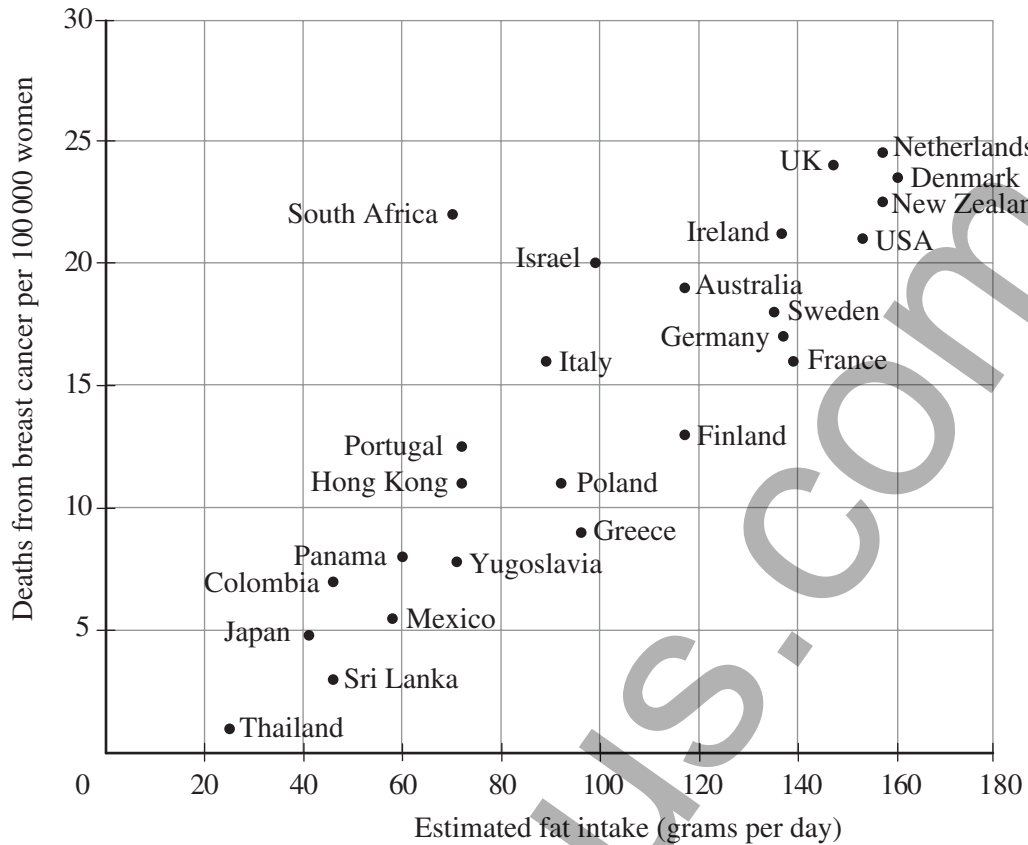


NOT TO SCALE

It is 8 am at P (30° N , 100° E). At which other location (A , B , C or D) is it also 8 am?

- (A) A (30° N , 70° E)
 (B) B (0° N , 130° E)
 (C) C (50° N , 100° E)
 (D) D (50° N , 130° E)

7.

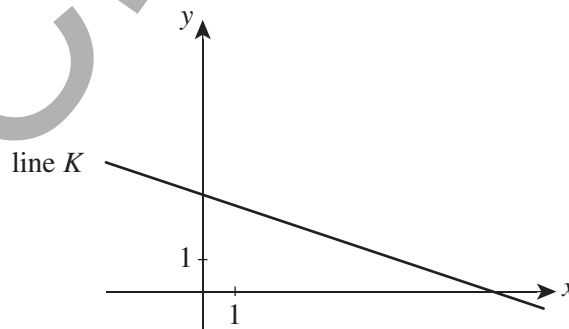


The scatter plot shows the average number of grams of fat eaten by women in a variety of countries and the number of deaths from breast cancer per 100 000 of population.

Which statement is a correct conclusion from the data?

- (A) Consuming large amounts of fat causes breast cancer.
- (B) There are more deaths per year from breast cancer in the Netherlands than in the USA.
- (C) The correlation between eating large amounts of fat and breast cancer is approximately 1.2.
- (D) The death rate from breast cancer increases as the amount of fat consumed increases.

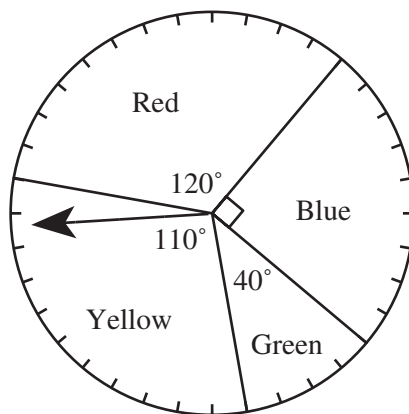
8.



Use a ruler and calculation to determine the gradient of line *K*.

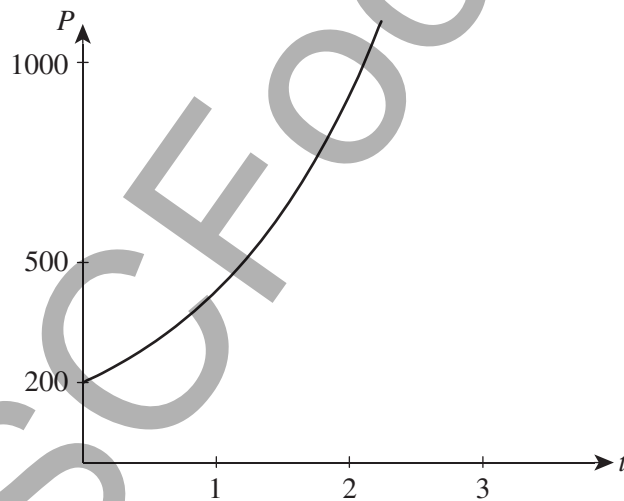
- (A) $-\frac{1}{3}$
- (B) $\frac{1}{3}$
- (C) -3
- (D) 3

9. The diagram shows a spinner used in a children's game.



What is the probability that the spinner will stop on either yellow or green?

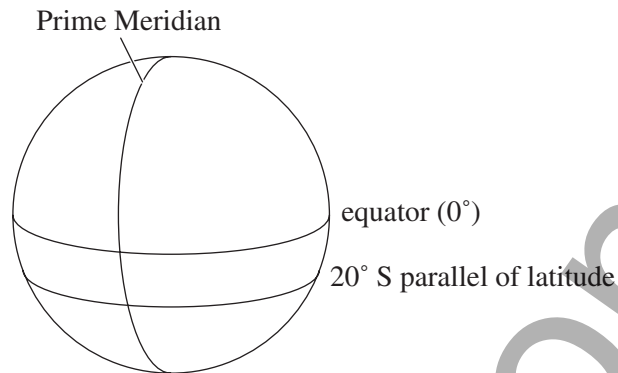
- (A) $\frac{1}{2}$
 (B) $\frac{2}{3}$
 (C) $\frac{5}{7}$
 (D) $\frac{5}{12}$
10. The graph shows the size of the population, P , at time t years.



What could be the equation of the graph?

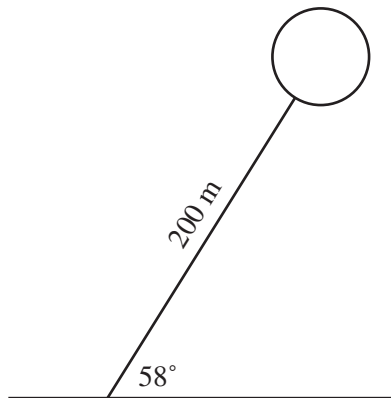
- (A) $P = 200t$
 (B) $P = 200t^2$
 (C) $P = \frac{200}{t}$
 (D) $P = 200 \times a^t$

11. The diagram shows the equator, the Prime Meridian and the 20° S parallel of latitude.



- Which of the three circles shown on the diagram are great circles?
- (A) Only the 20° S parallel of latitude.
(B) Only the Prime Meridian and the equator.
(C) Only the equator and the 20° S parallel of latitude.
(D) All three are great circles.
12. Andrew is going to start saving \$200 every month for the next 4 years. His special savings account pays 9% p.a. monthly compounding interest. How much interest will his investment earn during the 4 years?
- (A) \$864
(B) \$1375
(C) \$1904
(D) \$11504
13. One NSW political party is planning to include a radical new system to conserve water as part of its election campaign. The party wants to know whether voters want the new water system. Which one of the following procedures would be the most appropriate for obtaining a sample of voters?
- (A) Survey a random group of 20 people from each of the state's electorates.
(B) Survey a random sample of people who work for the Water Board.
(C) Survey every fifth person who visits election headquarters.
(D) Survey the first 200 people in the phone book.
14. Caleb is playing a gambling game. He has a $\frac{1}{10}$ chance of winning \$40, a $\frac{1}{2}$ chance of winning \$4 and a 0.4 chance of losing \$8. What is his financial expectation from this game?
- (A) win \$2.80
(B) lose \$2.80
(C) win \$9.20
(D) lose \$9.20

15.



An advertising balloon is attached to the ground with a 200 m rope. The angle between the rope and the ground is 58° . How high, to the nearest metre, is the balloon above the ground?

- (A) 106 m
(B) 170 m
(C) 236 m
(D) 302 m
16. Hassan has a holiday job painting identification labels on parking areas in a shopping complex. Each label uses one of the letters A, B, C, D and E and one of the digits 6, 7, 8 and 9 and he paints the codes in either red or blue.
How many different parking area labels can Hassan paint?
- (A) 11
(B) 20
(C) 40
(D) 90
17. The probability that a biased coin will land showing heads is $\frac{3}{5}$. In a game, the coin is going to be tossed 120 times. Calculate the expected number of times it will land showing tails.
- (A) 48
(B) 50
(C) 60
(D) 72

18. Some information about a home loan is given below.

Amount of the loan	\$70 000
Annual interest rate	6% p.a., monthly reducing
Monthly repayment (R)	\$800
Monthly interest	$\frac{\text{interest rate}}{12} \times \text{principal}$

N	Principal (P)	Interest (I)	P + I	P + I - R
1	70000	350	70350	69550
2				*

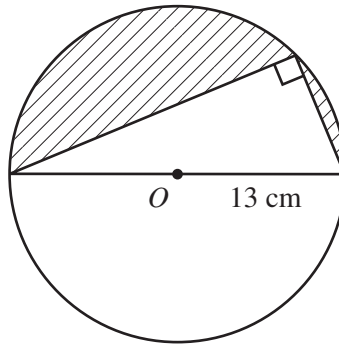
Correct to the nearest dollar, what value replaces the * in the table above?

- (A) 68750
 (B) 69098
 (C) 69100
 (D) 72923
19. Select the true statement about the data in this frequency table.

Score	Frequency
10	8
11	14
12	15
13	9
14	3

- (A) The standard deviation is 1.14, correct to 2 decimal places.
 (B) The sample standard deviation is 1.11, correct to 2 decimal places.
 (C) The standard deviation is bigger than the sample standard deviation.
 (D) The sample standard deviation is 0.01 larger than the standard deviation, correct to 2 decimal places.
20. The weight of newborn babies is normally distributed. The mean weight is 3.2 kg and the standard deviation is 0.4 kg.
 Approximately what percentage of newborn babies have a weight between 3.6 kg and 4.4 kg?
- (A) 16%
 (B) 27%
 (C) 32%
 (D) 49%

21.



The centre of the circle is O and the radius is 13 cm. One side of the triangle is 10 cm long. Calculate the size of the shaded area correct to 1 decimal place.

- (A) 145.5 cm²
- (B) 223.9 cm²
- (C) 410.9 cm²
- (D) 941.9 cm²

22. Lake Baikal in Siberia is one of the coldest places on Earth. Its typical winter temperature is -76 °F.

Use the formula $F = \frac{9}{5}C + 32$, where C = degrees Celsius and F = degrees Fahrenheit, to determine the typical winter temperature at Lake Baikal in degrees Celsius.

- (A) -24.4 °C
- (B) -60.0 °C
- (C) -104.8 °C
- (D) -194.4 °C

End of Section I

Section II

78 marks

Attempt Questions 23–28.

Allow about 2 hours for this section.

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

All necessary working should be shown in every question.

Marks

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

(a) Nabil earns \$14 per hour.

- | | |
|---|----------|
| (i) How much will he earn for working 5 hours at time-and-a-half? | 1 |
| (ii) On a public holiday, Nabil was paid double time and he earned \$84.
How many hours did he work on the public holiday? | 1 |
| (iii) Nabil works a 35-hour week. He receives a 17.5% holiday loading on 4 weeks' leave.
How much is his leave loading for his 4-week holiday. | 2 |

(b) The diagram shows a sign in a petrol station.



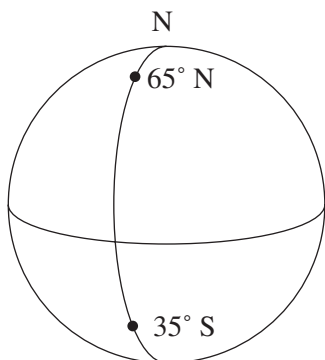
- | | |
|--|----------|
| (i) Jill's petrol bill came to \$68. How much will she pay if she receives 5% discount? | 1 |
| (ii) The regular cost of petrol at the time was \$1.28 per litre.
What percentage discount on the regular price is a 4c per litre discount? | 2 |
| (iii) The claim that 5% off is always better than 4c per litre off is wrong. Determine the price of one litre of petrol when the 5% discount is the same as the 4c per litre discount. | 2 |

Question 23 continues on page 12

Question 23 (Continued)

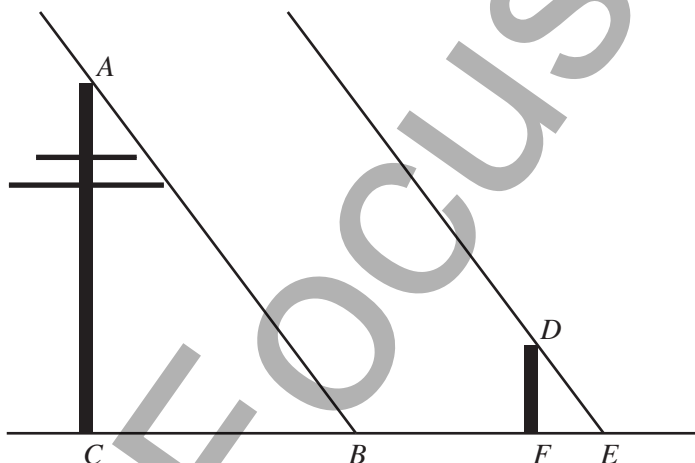
(c)

2



The radius of the Earth is 6400 km. Calculate the distance along the Greenwich meridian from 35° S to 65° N . Answer to the nearest kilometre.

(d)



At noon, the shadow of a telegraph pole is 3.6 m long and the shadow of a fence post is 0.9 m long.

- (i) What is the enlargement factor between the small triangle DEF and the large triangle ABC ? 1
- (ii) The fence post is 1.2 m high. Calculate the height of the telegraph pole. 1

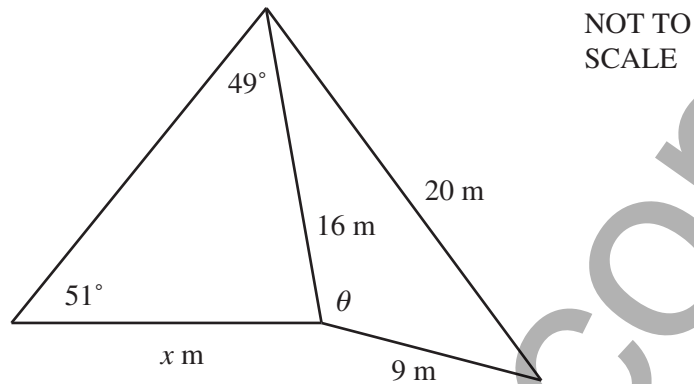
End of Question 23

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

(a) Simplify $\frac{8a^2b}{3x} \times \frac{x}{ab}$.

1

(b)



(i) Calculate the size of $\angle\theta$ correct to the nearest degree.

2

(ii) Determine the length of the side, x , correct to one decimal place.

2

(c) Police are concerned by an increase in ‘Mafia-type’ crime in the city. When the police interviewed 60 known criminals about their criminal activities, a forensic psychologist indicated whether or not he believed that the person being interviewed was a member of the Mafia. The results are shown in the table below.

	Mafia member according to psychologist	Not a Mafia member according to psychologist
A Mafia member		6
Not a Mafia member	4	42

(i) Calculate the value of the missing number in the table.

1

(ii) What is the ratio of people correctly identified by the psychiatrist (as either a Mafia member or not) to those who were incorrectly identified?

1

(iii) According to this data, what is the probability that a randomly selected criminal is a member of the Mafia?

1

(d) Suzette is self employed.

(i) Each quarter when she lodges her Business Activity Statement (BAS) she has to pay all the GST she has collected, as well as 18% of the money she has earned (excluding GST) as ‘Pay As You Go’ tax. Suzette charges 10% GST on all money she earns. During the last quarter, Suzette earned \$26400, including GST. Calculate the amount that Suzette will have to pay to the Tax Office with her BAS.

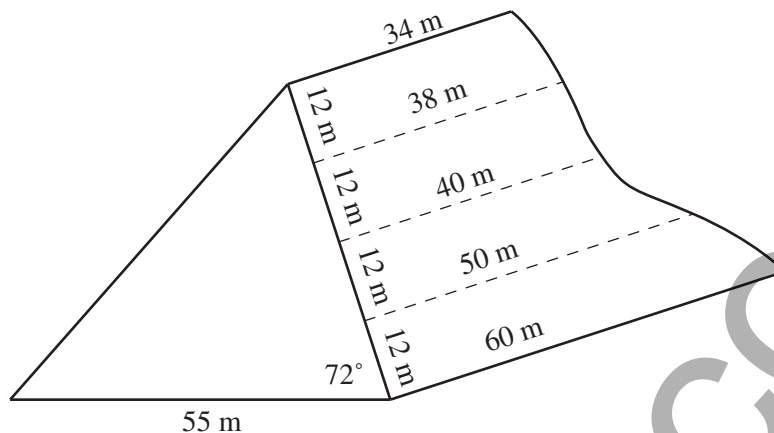
3

(ii) Suzette bought a \$4200 photocopier for her office, which she is depreciating using declining-balance depreciation at 25% p.a. Calculate the salvage value of Suzette’s photocopier when it is 3 years old.

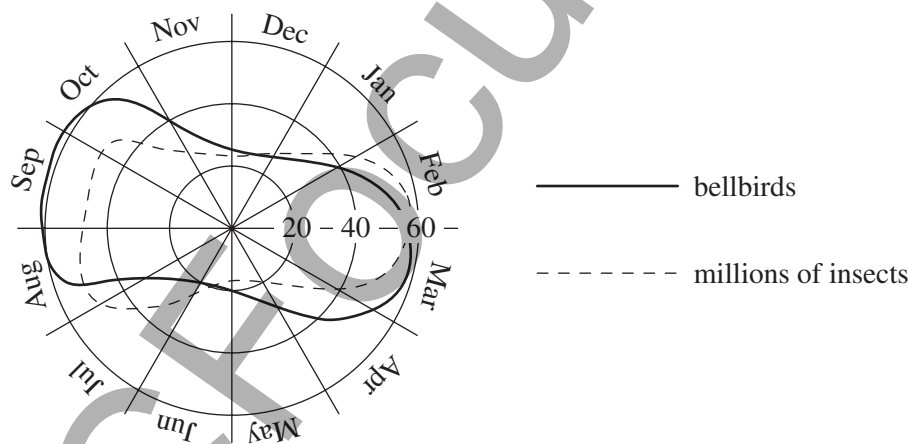
2

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

Bellbirds live in rainforest areas of NSW. The diagram shows the dimensions of one small pocket of rainforest.



- (a) Use two applications of Simpson’s rule and the formula for the area of a triangle to determine the area of the rainforest. 4
- (b) During the year, bellbirds move from one pocket of rainforest to another. The graph shows the numbers of bellbirds and insects living in a small pocket of rainforest during the year.

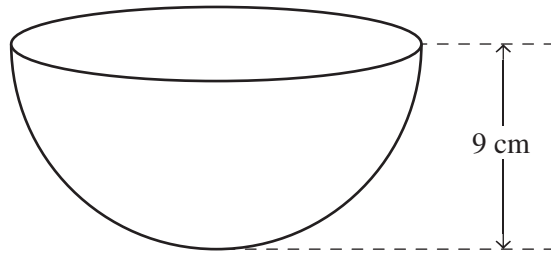


- (i) Approximately how many insects live in the area in December? 1
- (ii) During which season is the largest number of bellbirds in the area? 1
- (iii) Describe the similarities and differences between the number of insects and the number of bellbirds living in the area during different months of the year. 2

Question 25 continues on page 15

Question 25 (Continued)

- (c) The inside of a bellbird's nest has the shape of a hemisphere with a radius of 9 cm.

2

Calculate the volume of the space inside the bellbird's nest. Answer in cubic centimetres, correct to the nearest cm^3 .

- (d) The probability that a baby bellbird will survive to become an adult is 0.62. There are two baby bellbirds in a nest. What is the probability that

(i) they will both survive to become adults?

1

(ii) at least one of them will survive to become an adult?

2**End of Question 25**

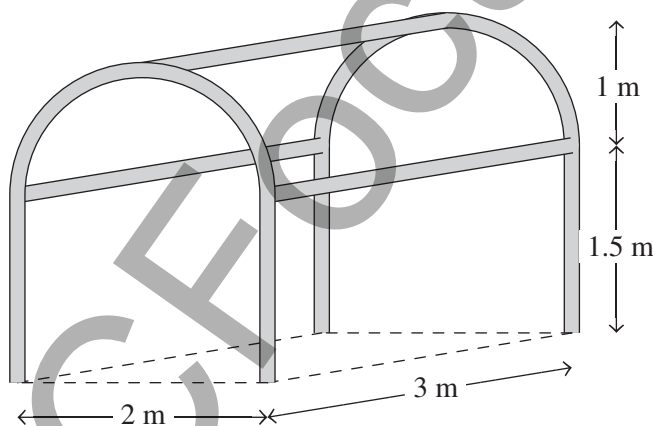
Question 26 (13 marks) Use a SEPARATE writing booklet.

- (a) This back-to-back stem and leaf plot shows the ages of 25 actors and 25 actresses when they won awards for Best Actor or Best Actress.

Actors (male)	Stem	Actresses (female)
	2	1 4 6 6 6
9 8 7 5 3 2 1	3	0 0 1 1 3 3 4 4 4 5 7
8 8 7 7 6 4 3 3 2 2 1 0	4	1 1 1 1 9
6 5 1	5	
2 0	6	0 1
6	7	4
	8	0

- (i) What is the median age of the male award winners? 1
- (ii) Determine the modal age of the female award winners. 1
- (iii) Which group has the smaller range? Show a calculation to justify your answer. 1
- (iv) Which group has the larger skew? Give a reason to support your answer. 1

(b)



Ron's shade house is in the shape of a rectangular prism with a half cylinder on top. It has no base.

- (i) Sketch the net of the shade house. 1
- (ii) Determine the surface area of the shade house. 3
- (iii) Ron uses poles made from PVC piping to support the shade house. He has 4 vertical poles, 3 horizontal poles and 2 semicircular poles. Each pole is indicated by a dark line on the diagram. 2

Calculate the length of PVC pipe Ron needs for the support poles.

Question 26 continues on page 17

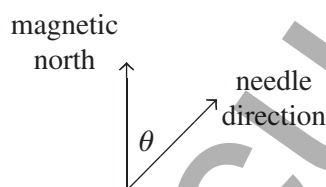
Question 26 (Continued)

- (c) Jake is investing \$1000 at 5% p.a. annually compounding interest.
- (i) Use the compound interest formula to show that the value of x in the equation $1000(1.05)^x = 2000$ represents the number of years it will take for Jake's investment to double. **1**
- (ii) By using estimation and refinement, or otherwise, determine the number of years it will take for Jake's investment to double. Answer correct to the nearest year. **1**
- (iii) Is it the size of the investment or the rate of interest that determines the number of years it takes for an investment to double? Use values to justify your answer. **1**

End of Question 26

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

- (a) Write the formula $4k = 50 + 2x^2$ with x as the subject. 2
- (b) Cassie borrowed \$150000 to buy a house. Her bank loan is to be repaid over 20 years at 9% p.a. monthly reducing interest.
- (i) Explain how you know that the monthly repayments will be approximately \$1350. 2
 - (ii) How much of her first repayment of \$1350 will be interest and how much will come of the principal? 2
 - (iii) Sketch a graph showing the amount that Cassie will owe on the loan in each month of the 20-year period of her loan. Label the axes carefully. 2
 - (iv) Including interest, how much will Cassie repay to the bank as a multiple of the amount she borrowed? Express your answer correct to 2 decimal places. 2
- (c) When David's compass is near an electrical current, the needle points east of magnetic north at an angle θ .



The size of θ is inversely proportional to the cube of the distance, x metres, between the compass and the electrical current.

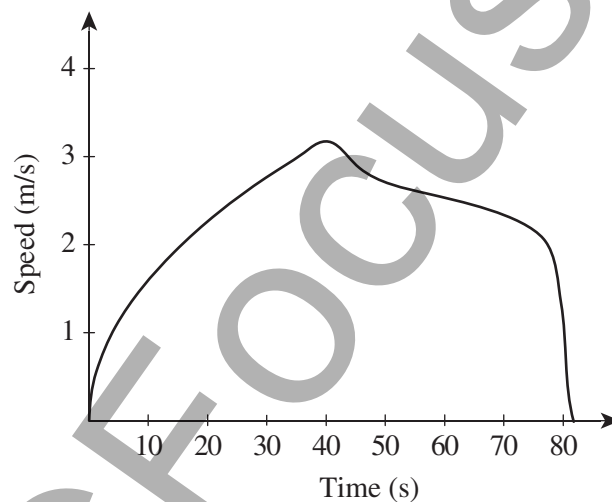
- (i) Explain why the formula $\theta = \frac{k}{x^3}$ represents the relationship between θ and x . 1
- (ii) When David's compass is 1.5 m from the electrical current, the size of θ is 5° . Determine the size of θ when $x = 50$ cm. 2

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

Jason is a swimming coach. He uses graphs and statistics to help improve the performance of his swimmers.

- (a) Jason uses the formula $R = \frac{1}{2}x^2 + 8x + \frac{1}{4}$ to determine the rate (R litres/minute) at which a swimmer uses oxygen at a given speed (x metres/second).
- (i) Explain why x must have a positive value in this context. **1**
- (ii) By constructing a table of values, or otherwise, sketch a graph showing values of R for values of x from 0 to 5. Take about half a page for your graph. **3**
- (iii) By using your graph, or otherwise, determine the speed at which a swimmer uses 12 litres of oxygen per minute. **1**
- (iv) The graph shows Amba's swimming speed during the first race at a carnival. **2**

Values on the horizontal axis are measured in seconds.



What was the maximum rate at which Amba used oxygen during the race?

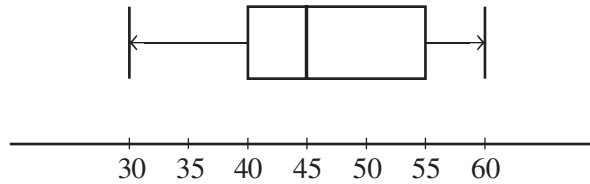
- (v) Swimming races have lengths of 50 m, 100 m, 200 m, 400 m, 800 m or 1500 m. **2**

Estimate the length of Amba's first race at the carnival. Use a calculation to justify your answer.

Question 28 continues on page 20

Question 28 (Continued)

- (b) Jason measured the resting pulse rates of 80 swimmers. He displayed his results on a box-and-whisker plot.



- (i) How many of the 80 swimmers had a resting pulse rate of 55 or less? **1**
- (ii) Jason measured the resting pulse rates of another 20 swimmers. He recorded 1 pulse rate of 28, 4 pulse rates between 30 and 40, and 15 pulse rates between 45 and 50. Then he drew another box-and-whisker plot showing the combined data from his first 80 swimmers and the additional 20 swimmers. **3**

Compare and contrast Jason's first and second box-and-whisker plots.

End of paper

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: $A = 2\pi rh + 2\pi r^2$

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

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

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

\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:

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