BOARD OF STUDIES
NEW SOUTH WALES

2001

HIGHER SCHOOL CERTIFICATE EXAMINATION

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black or blue pen
- Calculators may be used
- A formulae sheet is provided at the back of this paper
- Write your Centre Number and Student Number at the top of page 29

Total marks – 100

Section I Pages 2–12

22 marks

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

Section II Pages 13–26

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.

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

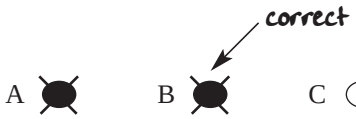
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

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 the correct answer by writing the word **correct** and drawing an arrow as follows.



A ● B ⊗ C ○ D ○

1 Alex works in a shop where the normal weekday rate of pay is \$12 per hour. On Saturdays she is paid time-and-a-half.

How much did Alex earn in a week in which she worked for seven hours on Thursday and three hours on Saturday?

(A) \$84

(B) \$120

(C) \$138

(D) \$180

2 If $w = \dfrac{15y}{y + 12}$, and $y = 7$, find the value of w (correct to two decimal places).

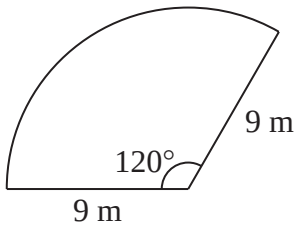
(A) 5.53

(B) 8.26

(C) 15.75

(D) 27.00

3 This is a sketch of a sector of a circle.



Calculate the area of this sector (correct to one decimal place).

(A) 9.4 m^2

(B) 18.8 m^2

(C) 36.8 m^2

(D) 84.8 m^2

4 Frank has a credit card with an interest rate of 0.05% per day and no interest-free period.

Frank used the credit card to pay for car repairs costing $480. He paid the credit card account 16 days later. What is the total amount (including interest) that he paid for the repairs?

(A) $480.24

(B) $483.84

(C) $504.00

(D) $864.00

5 Simplify $3(x-2)-2(x-1)$.

(A) $x-4$

(B) $x-3$

(C) $x-1$

(D) $x-8$

6 The number represented by a 1 followed by one hundred zeros is called a googol.

Which of the following is equal to a googol?

(A) 10^2

(B) 10^{10}

(C) 10^{99}

(D) 10^{100}

7 Brenda surveyed the students in her year group and summarised the results in the following table.

	Play tennis	*Do not play tennis*	TOTALS
Right-handed	53	81	134
Left-handed	22	29	51
TOTALS	75	110	185

What percentage of the left-handed students in this group play tennis? (Round your answer to the nearest whole number.)

(A) 11%

(B) 12%

(C) 29%

(D) 43%

8 The following frequency table shows Ravdeep's scores on a number of quizzes.

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

Which expression gives Ravdeep's mean score?

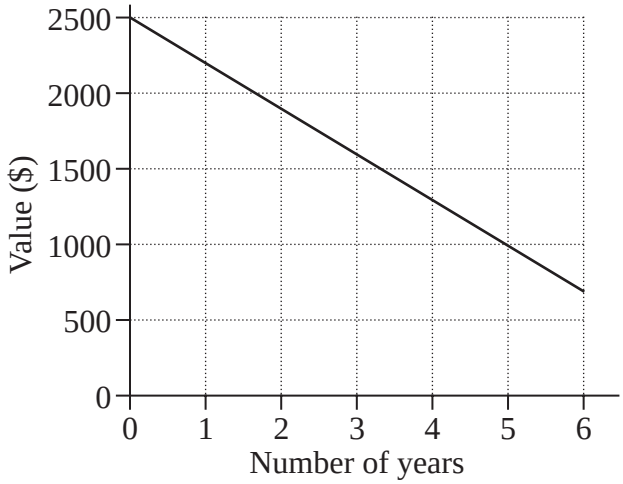
(A) $\frac{2 + 6 + 15 + 8 + 5}{13}$

(B) $\frac{2 + 6 + 15 + 8 + 5}{5}$

(C) $\frac{1 + 2 + 3 + 4 + 5}{13}$

(D) $\frac{1 + 2 + 3 + 4 + 5}{5}$

9 A computer was purchased for $2500 and depreciated over six years, as shown in the graph.



By how much did the computer depreciate each year?

(A) $200

(B) $250

(C) $300

(D) $350

10 The table shows personal income tax rates.

Taxable income	*Tax on this income*
$0 – $6 000	Nil
$6 001 – $20 000	17 cents for each $1 over $6 000
$20 001 – $50 000	$2 380 plus 30 cents for each $1 over $20 000
$50 001 – $60 000	$11 380 plus 42 cents for each $1 over $50 000
$60 001 and over	$15 580 plus 47 cents for each $1 over $60 000

Sandra has a gross income of $60 780 and deductions that total $2420.

What is the tax payable on Sandra's taxable income?

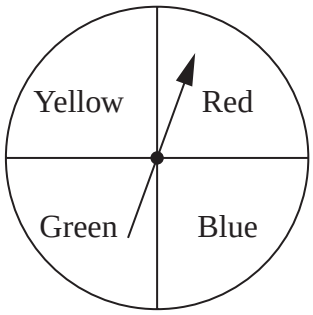
(A) $13 526.60

(B) $14 891.20

(C) $15 946.60

(D) $17 084.00

11



The arrow is spun and will point to one of the four colours when it stops.

If the arrow is spun twice, what is the probability that it points to the same colour both times it stops?

(A) $\frac{1}{16}$

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

(C) $\frac{1}{4}$

(D) $\frac{1}{2}$

12 Josephine invested \$1000 at the end of each year for five years. Her investment earned interest at 4.8% per annum compounded annually.

What was the total value of Josephine's investment (to the nearest dollar) at the end of the fifth year?

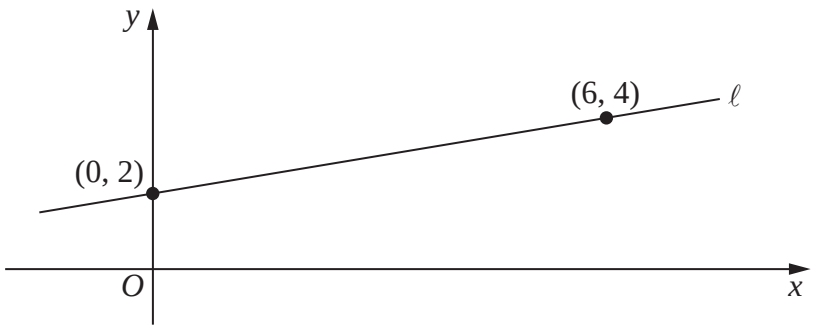
(A) \$5024

(B) \$5240

(C) \$5504

(D) \$6321

13



What is the equation of the line ℓ?

(A) $y = 6x + 2$

(B) $y = x + 2$

(C) $y = 3x + 2$

(D) $y = \frac{1}{3}x + 2$

14 Joyce measures the length of a piece of wood as 250 mm, correct to the nearest mm.

What is the percentage error in her measurement?

(A) ±0.002%

(B) ±0.004%

(C) ±0.2%

(D) ±0.4%

Use the back-to-back stem-and-leaf plot to answer Questions 15 and 16.

SCORES ON A CLASS TEST

Boys		*Girls*
9 8 8	0	6
5 4 4 2 2	1	2 2 5 8
9 3 1 1	2	1 3 3 4 5 5 6
5 4 2	3	2 2 4

15 What is the range of scores in this class test?

(A) 27

(B) 28

(C) 29

(D) 35

16 Find the median score for the boys in this class test.

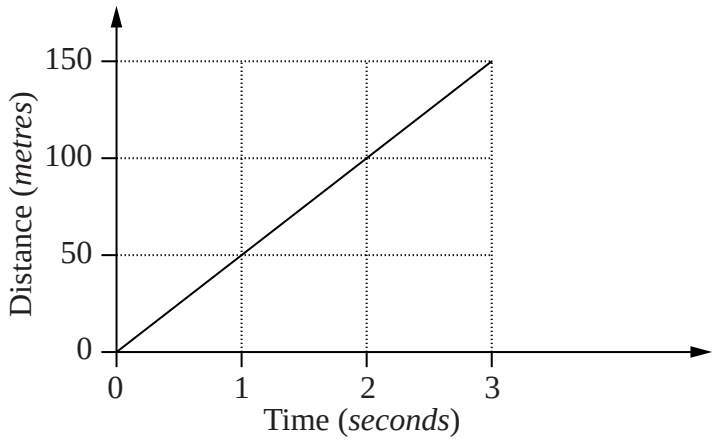
(A) 12

(B) 15

(C) 19

(D) 21

17 The distance–time graph for a moving object is shown.



What is the speed of the object in *kilometres per hour*?

(A) 3 km/h

(B) 14 km/h

(C) 50 km/h

(D) 180 km/h

18 A sphere has a volume of 360 cm^3.

What is its radius (correct to one decimal place)?

(A) 1.7 cm

(B) 4.4 cm

(C) 8.1 cm

(D) 9.3 cm

19 A factory produces bags of flour. The weights of the bags are normally distributed, with a mean of 900 g and a standard deviation of 50 g.

What is the best approximation for the percentage of bags that weigh more than 1000 g?

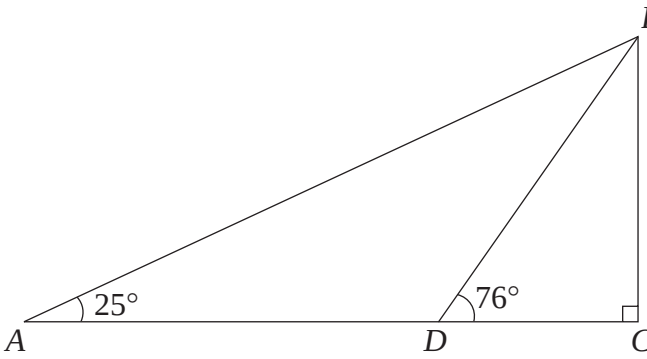
(A) 0%

(B) 2.5%

(C) 5%

(D) 16%

20 Calculate the length of *AD* (to the nearest metre).



NOT TO SCALE

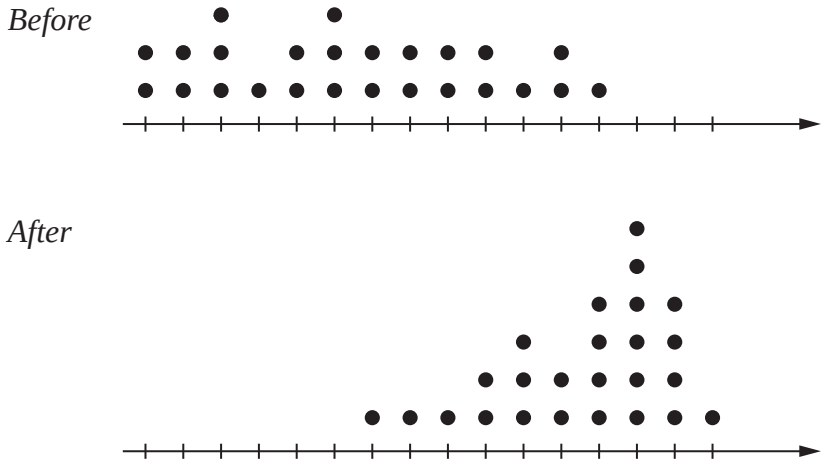
(A) 25 m

(B) 134 m

(C) 190 m

(D) 214 m

21 The dot plots below are drawn on the same scale. They show the class scores in tests taken before and after a unit of work was completed.



Which statement about the change in scores is correct?

(A) The mean increased and the standard deviation decreased.

(B) The mean increased and the standard deviation increased.

(C) The mean decreased and the standard deviation decreased.

(D) The mean decreased and the standard deviation increased.

22 Sonia has written letters to four of her friends and sealed the letters in envelopes. Now she does not know which envelope contains which letter.

If Sonia addresses the envelopes to her four friends at random, what is the probability that each envelope contains the correct letter?

(A) $\frac{1}{256}$

(B) $\frac{1}{24}$

(C) $\frac{1}{16}$

(D) $\frac{1}{4}$

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.

Marks

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

(a) The 11 people in Sam's cricket team always bat in the same order. Sam recorded the batting order and the average number of runs scored by each player during the season.

Batting order	*Average number of runs*
1	16
2	10
3	11
4	8
5	7
6	4
7	4
8	5
9	3
10	1
11	1

(i) Display the data as a scatterplot on the graph paper provided on page 29. Make sure that you have labelled the axes. **2**

(ii) Draw a line of fit on your scatterplot on the graph paper provided on page 29. (No calculations are necessary.) **1**

(iii) Using your scatterplot, describe the correlation between the batting order and the average number of runs. **1**

Question 23 continues on page 14

Question 23 (continued)

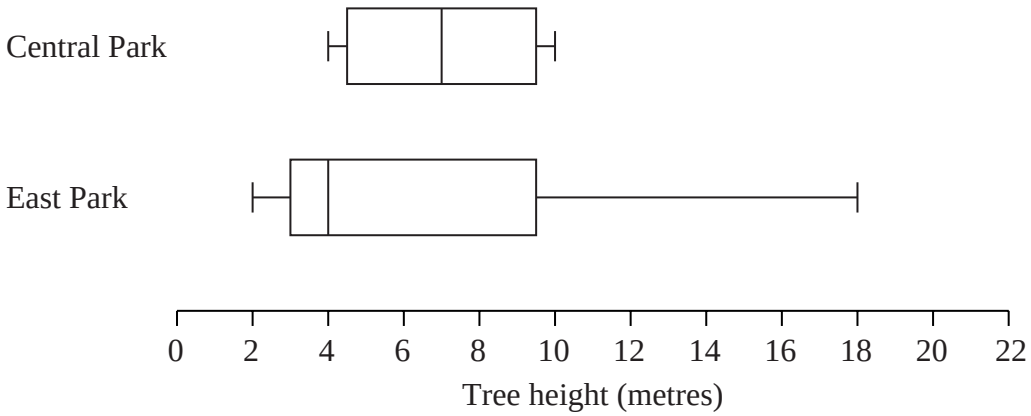
(b) Results for a reading test are given as *z*-scores. In this test, Kim gained a *z*-score equal to –2.

(i) Interpret this *z*-score in terms of the mean and standard deviation of the test. **2**

(ii) If the test has a mean of 75 and a standard deviation of 5, calculate the actual mark scored by Kim. **1**

(c) Andy and her biology class went to two large city parks and measured the heights of the trees in metres.

In Central Park there were 25 trees. In East Park there were 27 trees. The data sets were displayed in two box-and-whisker plots.



(i) In which park is the tallest tree, and how high is it? **2**

(ii) What is the median height of trees in Central Park? **1**

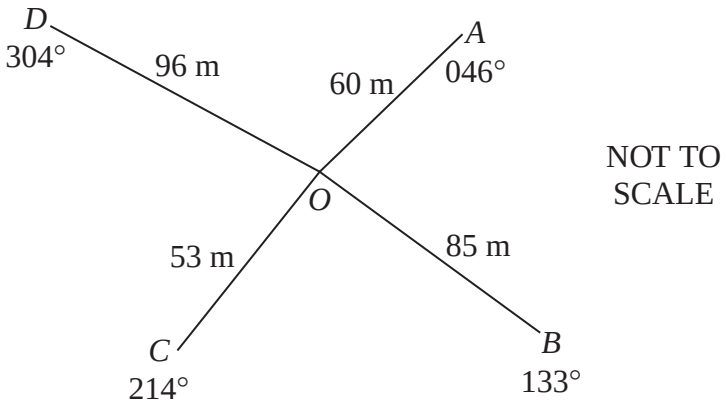
(iii) Compare and contrast the two data sets by examining the shape and skewness of the distributions, and the measures of location and spread. **3**

End of Question 23

Marks

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

(a) The following notebook entry was made during a radial survey of a field.



(i) What is the size of $\angle AOB$? **1**

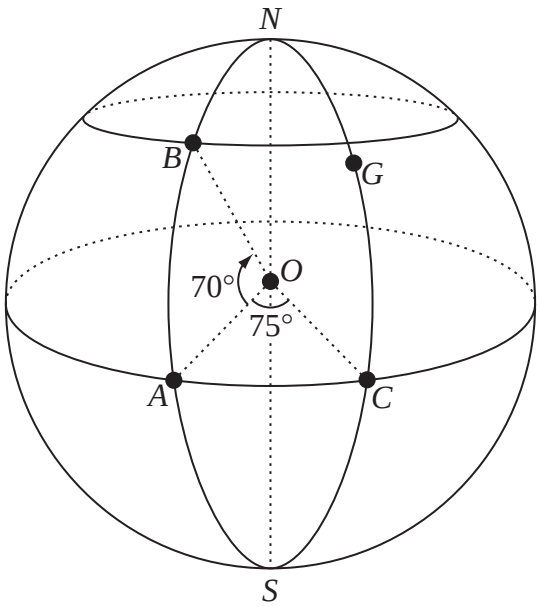
(ii) Calculate the area of triangle AOB. Round your answer to the nearest square metre. **2**

(iii) Find the distance from A to B. **2**

Question 24 continues on page 16

Question 24 (continued)

(b)



NOT TO SCALE

In this diagram of the Earth, *O* represents the centre and *G* represents Greenwich. The point *A* lies on the equator.

(i) What is the time difference between Greenwich and point *A*? (Ignore time zones.) **1**

(ii) What is the latitude of point *B*? **1**

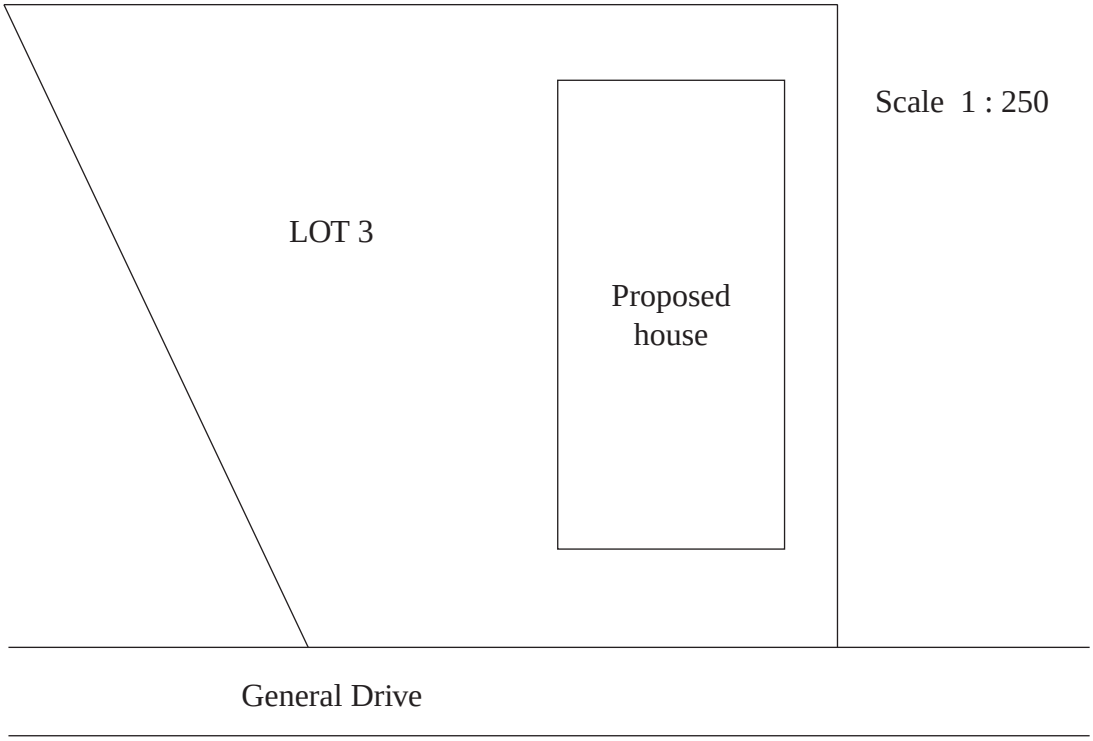
(iii) Calculate, to the nearest kilometre, the great circle distance from point *A* to point *B*. (You may assume that the radius of the Earth is 6400 km, and that 1 nautical mile = 1.852 km.) **2**

Question 24 continues on page 17

Marks

Question 24 (continued)

(c) This is a site plan, drawn to scale, of Lot 3, General Drive.



(i) A fence is to be erected along all boundaries of Lot 3 except for the boundary on General Drive. How many metres of fencing will be required? **2**

(ii) Lot 3 is in the shape of a trapezium. By measurement and calculation, determine the actual area of Lot 3 in square metres. **2**

End of Question 24

Marks

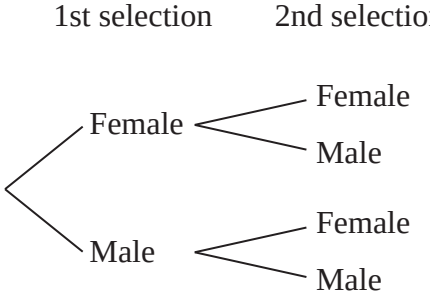
Question 25 (13 marks) Use a SEPARATE writing booklet.

(a) Five men and three women are living on an island, but not all will be able to stay.

(i) If one person is selected at random, what is the probability that this person is female? **1**

(ii) Two people are to be randomly selected to leave the island.

1 Copy the tree diagram into your writing booklet, and complete the diagram by writing the probabilities on all the branches. **2**



2 Calculate the probability that the selection includes exactly one female. **2**

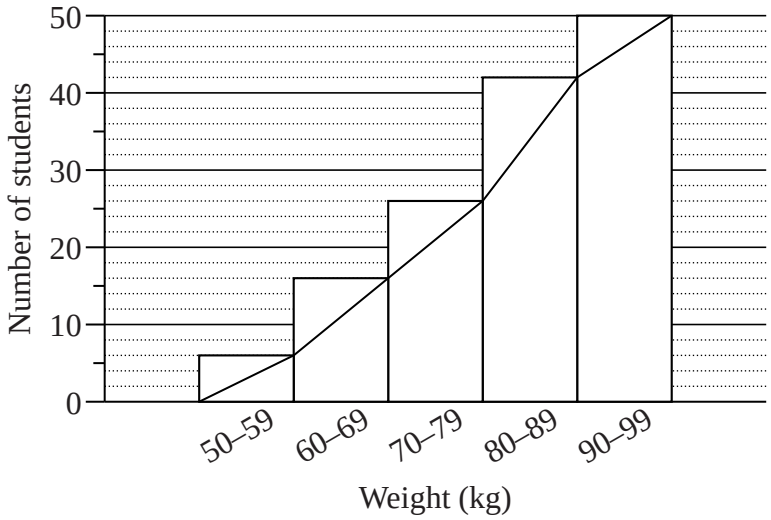
(iii) Antoinette is one of the women on the island. Before the two people are randomly selected to leave, Antoinette calculates her chance of remaining on the island. She concludes that she has a good chance of remaining. **2**

Do you agree? Justify your answer.

Question 25 continues on page 19

Question 25 (continued)

(b) Armand recorded the weights of a random sample of male students in his Year. The cumulative frequency graph displays the results.



(i) How many of the students surveyed were in the 80–89 kg class? **1**

(ii) Estimate the median weight of the students surveyed. **1**

(iii) Of the 300 male students in Armand's Year, how many would you expect to weigh less than 70 kg? **2**

(iv) 1 In order to select a sample, Armand's friend suggested selecting the first 50 male students in his Year to arrive at school on Monday morning. Explain why this would NOT be a random sample. **1**

2 Describe a method that could have been used to select a random sample of the male students. **1**

End of Question 25

Marks

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

(a) Otto is the manager of a weekend market in which there are 220 stalls for rent. From past experience, Otto knows that if he charges d dollars to rent a stall, then the number of stalls, s, that will be rented is given by:

$$s = 220 - 4d.$$

(i) How many stalls will be rented if Otto charges \$7.50 per stall? **1**

(ii) Copy and complete the following table for the function $s = 220 - 4d$. **1**

d	10	30	50
s			

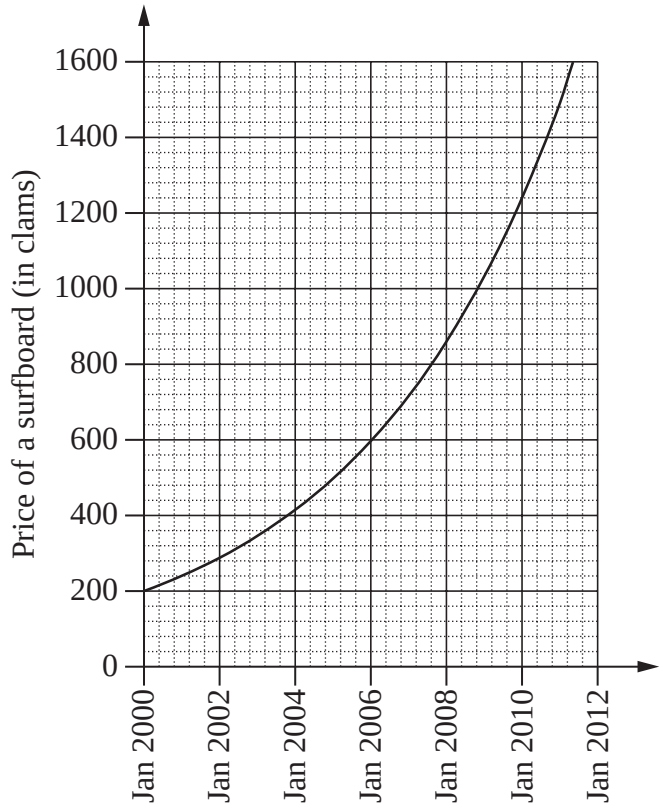
(iii) Draw a graph of the function $s = 220 - 4d$. **2**
Use your ruler to draw the axes. Label each axis, and mark a scale on each axis.

(iv) Does it make sense to use the formula $s = 220 - 4d$ to calculate the number of stalls rented if Otto charges \$60 per stall? Explain your answer. **1**

Question 26 continues on page 21

Question 26 (continued)

(b) On the island of Wupetoi the unit of currency is the clam. The rate of inflation on Wupetoi has been constant for many years. Assuming the rate of inflation remains constant, the price of a surfboard will increase as shown in the graph.



(i) The formula used to draw this graph was $P = A \times (1.2)^t$,

where P = price of a surfboard
and t = number of years after January 2000.

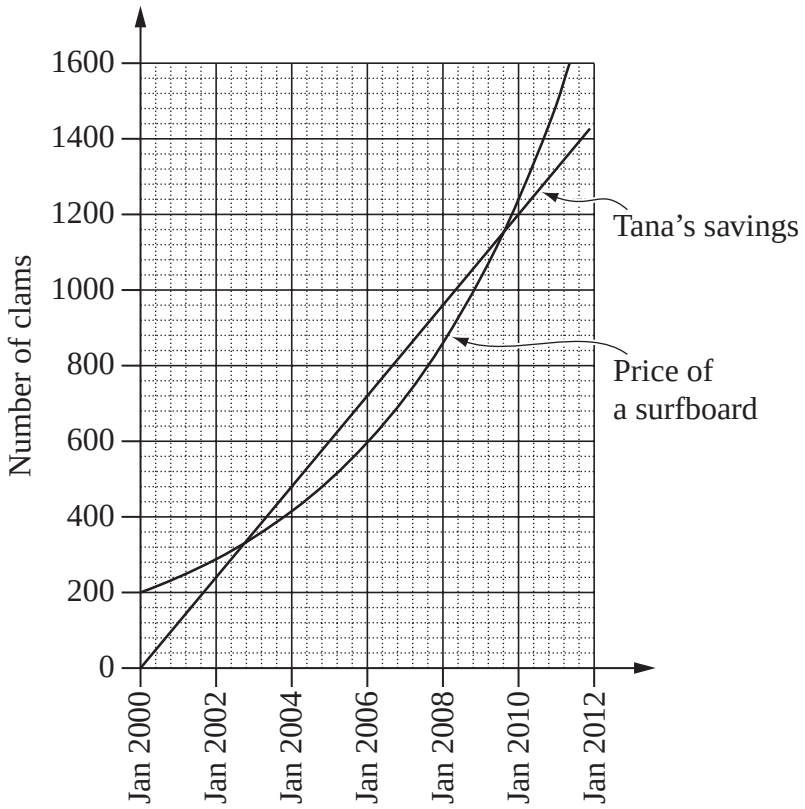
1 What is the value of A, and what does it represent? **2**

2 What annual rate of inflation has been assumed? **1**

Question 26 continues on page 22

(ii) In January 2000, Tana started saving a fixed number of clams each month, in order to buy a surfboard.

The straight line on the graph below represents Tana's savings.



1 During which year will Tana first be able to afford a surfboard? Explain your answer. **2**

2 If Tana uses his savings to buy a surfboard in January 2006, how many clams will he have left? **1**

3 Write an equation that describes the relationship between Tana's savings in clams (c) and the number of months (n) after January 2000. **2**

End of Question 26

Marks

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

(a) George buys a television for $574.20, including 10% GST. **1**

What is the value of the GST component?

(b) A car is purchased for $42 000. **2**

Use the declining balance method to calculate the salvage value of the car after 4 years at a depreciation rate of 15% per annum.

(c) Derek and Rosetta both reached the age of 55 in 2001. They had each contributed regularly to an investment fund.

Both investments earned interest at the rate of 6% per annum compounded monthly.

INVESTMENT DETAILS				
	Monthly contribution	*Number of years*	*Total contribution*	***Value of investment in 2001***
Derek	$400	15 (from the age of 40)	$72 000	**$116 327**
Rosetta	$200	30 (from the age of 25)	$72 000	**$200 903**

(i) Explain the large difference between the values of their investments in 2001, given that Derek and Rosetta had each contributed $72 000. **1**

(ii) If they each continue their regular monthly contributions for a further 5 years, will the difference between the values of their investments grow larger? Justify your answer with appropriate calculations. **3**

Question 27 continues on page 24

Question 27 (continued)

(d) Ted has borrowed \$70 000 at an interest rate of 6.24% per annum compounded monthly. The repayments have been set at \$680 per month.

The loan balance sheet shows the interest charged and the balance owing for the first month.

Month	*Principal (at start of month)*	*Monthly interest*	*Monthly repayment*	*Balance (at end of month)*
1	\$70 000	$\$70\,000 \times 0.0052 = \$364$	\$680	\$69 684
2	\$69 684	*A*	\$680	*B*

(i) Explain why 0.0052 is used to calculate the monthly interest. **1**

(ii) Find the missing amounts at *A* and *B*. **2**

(iii) Ted would like to calculate the number of months, *n*, it will take to repay the loan fully. He uses a 'guess-and-check' method to estimate *n* in the following equation:

$$\$680 \times \left\{ \frac{(1.0052)^n - 1}{0.0052 \times (1.0052)^n} \right\} = \$70\,000 .$$

Here is his working.

Try $n = 200$:

$$\$680 \times \left\{ \frac{(1.0052)^{200} - 1}{0.0052 \times (1.0052)^{200}} \right\} \div \$84\,424$$

Hence $n = 200$ is too big.

1 Ted's next guess is $n = 120$. Show Ted's working for this guess, including the calculation and the conclusion. **2**

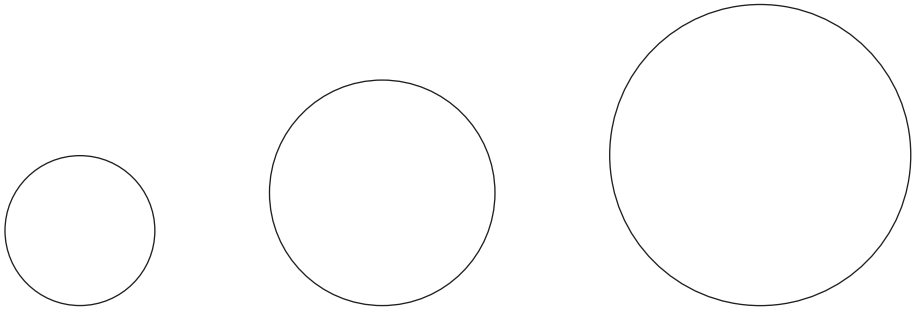
2 State a reasonable value of *n* for the next guess. **1**

End of Question 27

Marks

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

(a) Joe's pizzas are made in three different sizes.



Mini Standard Large

Joe puts olives on all his pizzas. The number of olives depends on the size of the pizza, as shown in the table.

Size	*Diameter, d* (cm)	*Number of olives, n*
Mini	20	8
Standard	30	18
Large	40	32

The relationship between the diameter of the pizza and the number of olives can be expressed by the formula:

$$n = kd^2, \quad \text{where } k \text{ is a constant.}$$

(i) Use a pair of values from the table to show that $k = 0.02$. **1**

(ii) Joe decides to make a mega-pizza, with diameter 52 cm. **1**

Use the formula to find the number of olives needed for a mega-pizza.

(iii) Joe is asked to make a pizza in the shape of a square with sides of length 25 cm. He decides to use the same number of olives as would be needed on a round pizza with the same area. **3**

How many olives will be needed?

Question 28 continues on page 26

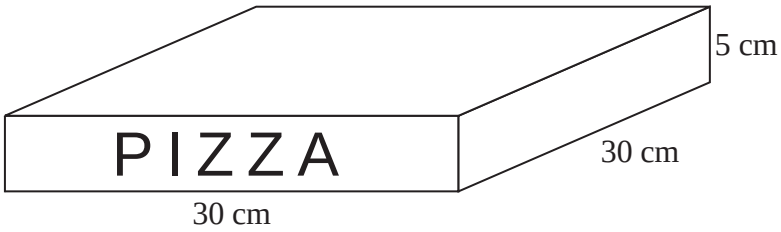
Marks

Question 28 (continued)

(b) Joe uses a microwave oven to heat lasagne. The time taken for heating is inversely proportional to the power setting (in watts). It takes ten minutes at a power setting of 240 watts to heat the lasagne. **3**

How long would it take at a power setting of 500 watts?

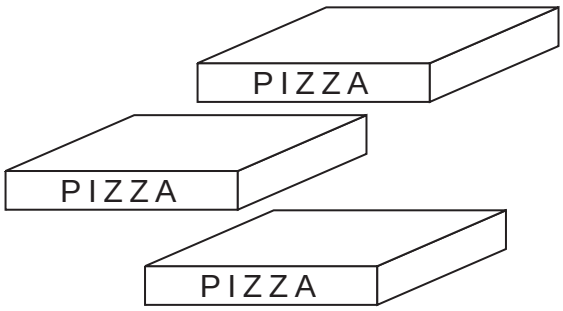
(c) Joe's standard pizza boxes have dimensions as shown.



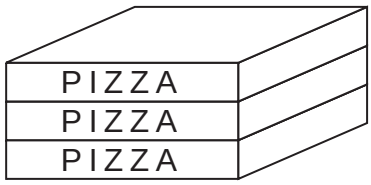
NOT TO SCALE

(i) What is the surface area of one box? **1**

(ii) The surface area of a stack of these boxes is less than the total surface area of the individual boxes in the stack. **4**



Three individual boxes



A stack of three boxes

Write down the formula for the surface area of N individual boxes AND determine a formula for the surface area of a stack of N boxes.

End of paper

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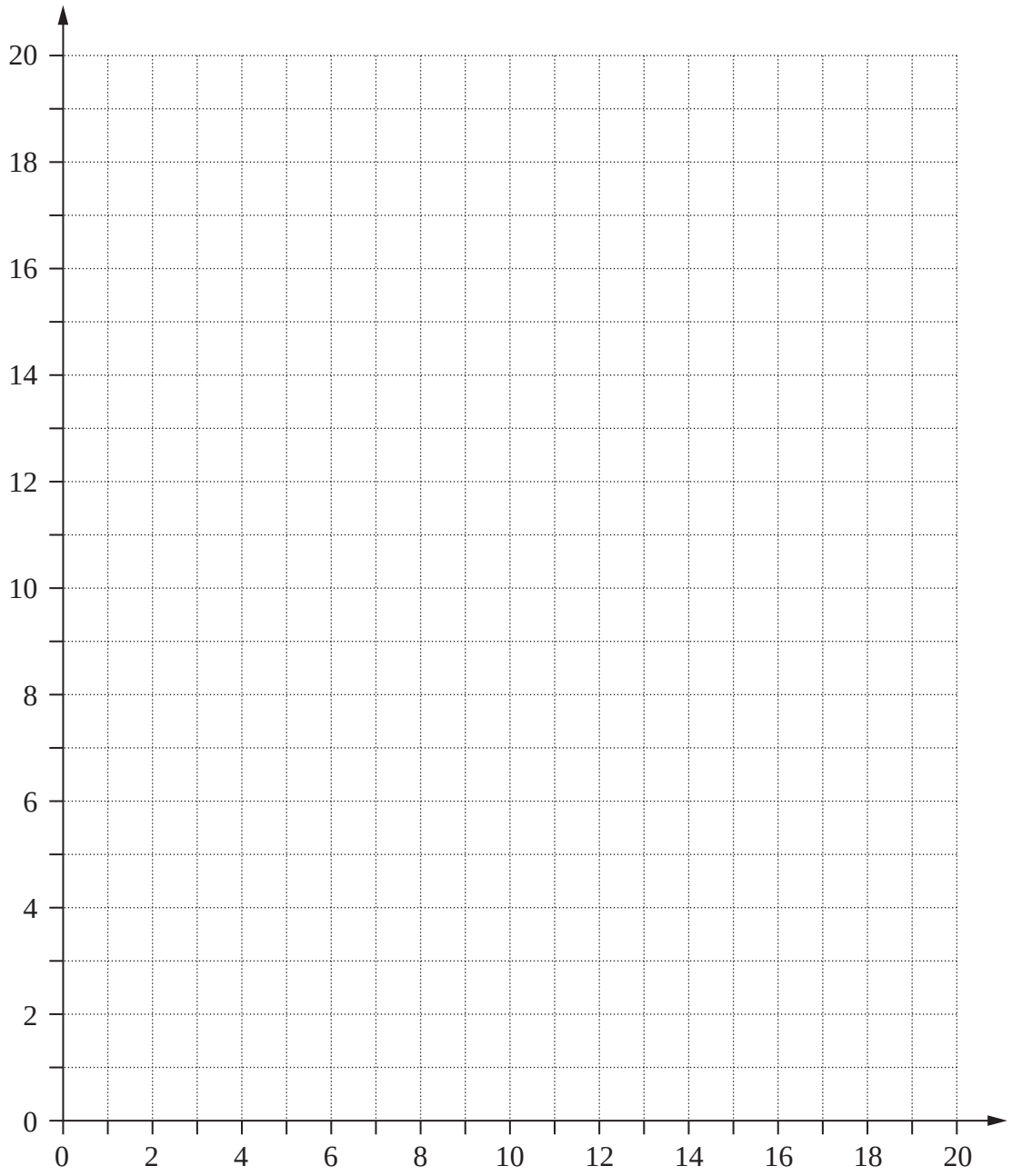
General Mathematics

Centre Number

Student Number

This page is to be detached, completed and attached to the inside front cover of your writing booklet for Question 23.

Question 23 (a) (i) and (ii)



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FORMULAE SHEET

Area of an annulus

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

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

Surface area of a sphere

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

Simpson's rule for area approximation

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

h = distance between successive measurements
d_f = first measurement
d_m = middle measurement
d_l = last measurement

Volume

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

Cylinder $V = \pi r^2 h$

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

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

A = area of base
h = perpendicular height

Mean of a sample

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

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

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

Formula for a *z*-score

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

s = standard deviation

Probability of an event

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

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

FORMULAE SHEET

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

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

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

Gradient of a straight line

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

Gradient–intercept form of a straight line

$y = mx + b$

m = gradient
b = y-intercept