

NSW INDEPENDENT SCHOOLS

2014
Higher School Certificate
Trial Examination

Mathematics General 2

General Instructions

- Reading time -- 5 minutes
- Working time -- 2½ hours
- Write using black or blue pen
- Board-approved calculators may be used
- Draw diagrams using pencil
- A Formulae Sheet is provided
- Write your student number and/or name at the top of every page

Total marks – 100

Section I – Pages 2–14
25 marks

- Attempt Questions 1–25
- Allow about 35 minutes for this section

Section II – Pages 15–30
75 marks

- Attempt Questions 26–30
- All questions are of equal value
- Allow about 1 hour 55 minutes for this section

This paper MUST NOT be removed from the examination room

Section I

25 marks
Attempt Questions 1–25
Allow about 35 minutes for this section

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
1				
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	A	B	C	D
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24				
25				

- 1 The catchment area of a dam covers an area of 7.5×10^9 square metres.

How many hectares is this area equivalent to?

- (A) 7 500
 (B) 75 000
 (C) 750 000
 (D) 7 500 000
- 2 Taylor works casually and was at his office on Monday from 8:30 am until 4:00 pm. He is paid at the rate of \$36.20 per hour, excluding 45 minutes allowed for unpaid meal breaks.

How much was Taylor paid for his work on Monday?

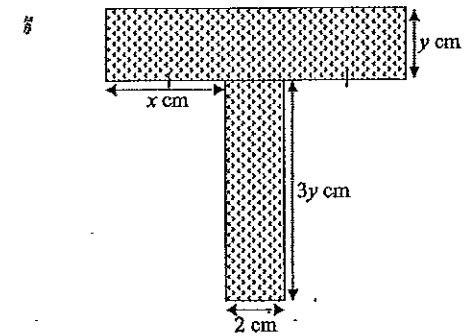
- (A) \$244.35
 (B) \$262.45
 (C) \$280.55
 (D) \$298.65
- 3 The volume (V) of liquid (mL) in a beaker at any time t (in minutes) is given by the linear function:

$$V = 2t + 10$$

At what rate (mL/min) is the quantity of liquid in the beaker increasing?

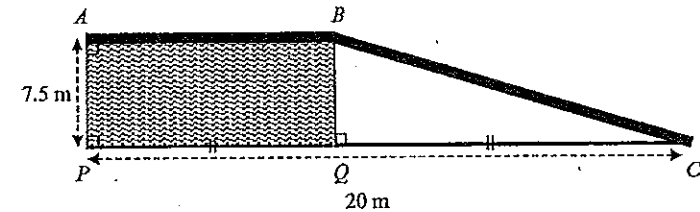
- (A) 2
 (B) 8
 (C) 10
 (D) 12

- 4 A telecommunications company has a "T" as its signature sign.



Which of these expressions would give the area (in cm^2) of this front surface of the "T" sign?

- (A) $2xy + 6y$
 (B) $2xy + 8y$
 (C) $4xy + 6y$
 (D) $2x + 8y$
- 5 The base PC of this boat ramp has length 20 metres and it has a maximum height above its base of 7.5 metres.



If $PQ = QC$, what is the total length (to one decimal place) of the ramp from A to B to C ?

- (A) 16.6 m
 (B) 22.5 m
 (C) 27.5 m
 (D) 30.0 m

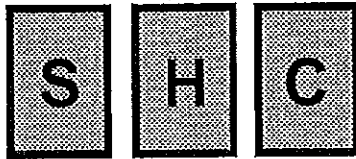
6 The time difference between two world cities A and B, both situated on the 20°N latitude, is 14 hours.

City A lies on the 90°W longitude and is west of city B.

On what longitude does city B lie?

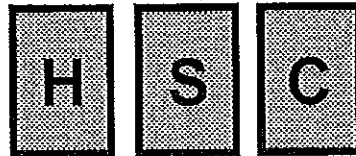
- (A) 30°W
- (B) 30°E
- (C) 120°E
- (D) 210°E

7 Three letters S, H and C are written on separate cards.



The cards are turned over, shuffled and placed face down next to each other on a table.

What is the probability that the cards from left to right appear, as shown below?



- (A) $\frac{1}{3}$
- (B) $\frac{1}{4}$
- (C) $\frac{2}{3}$
- (D) $\frac{1}{6}$

8 The future value of an annuity with a contribution of \$1 is shown in the following table for various interest rates per period.

Future Value of \$1

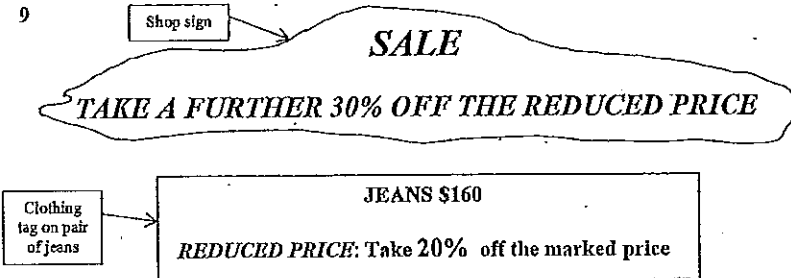
Period	2.0%	2.5%	3.0%	3.5%	4%	4.5%	5%
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.020	2.025	2.030	2.035	2.040	2.045	2.050
3	3.060	3.076	3.091	3.106	3.122	3.138	3.153
4	4.122	4.153	4.184	4.215	4.246	4.277	4.310
5	5.204	5.256	5.309	5.362	5.416	5.470	5.526
6	6.308	6.388	6.468	6.550	6.633	6.716	6.802

Malcolm deposits \$3600 into an investment account every 6 months over a period of 3 years.

Interest is added to Malcolm's account at the rate of 5% p.a., compounded 6 monthly.

How much interest will Malcolm earn on his investment?

- (A) \$547.20
- (B) \$873.60
- (C) \$1396.80
- (D) \$2887.20



How much does Dilshan save off the original price if he buys a pair of jeans?

- (A) \$64
- (B) \$70.40
- (C) \$80.00
- (D) \$89.60

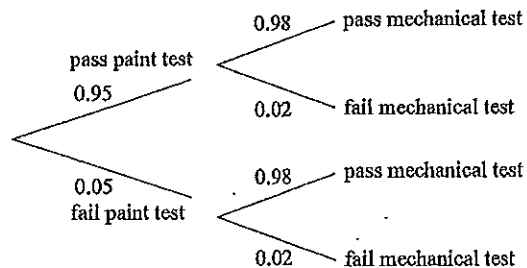
- 10 The number of matchsticks counted in 15 randomly selected cartons was recorded in a stem-and-leaf plot shown below.

15	1 1 1 2
16	0 0 3 3 3 3
17	2 3 5
18	0 1

What is the cumulative frequency of 163?

- (A) 4
 (B) 6
 (C) 7
 (D) 10
- 11 New cars off the production line have a probability of 0.95 of passing a paint test and a probability of 0.98 of passing a mechanical test.

A probability tree diagram shows this information for both tests.



What is the probability that a car randomly selected off the production line will pass at least one of the two tests?

- (A) 93%
 (B) 96.5%
 (C) 99.9%
 (D) 100%

- 12 Which of the following correctly expresses p as the subject of $q = \frac{4}{9p^2}$?

(A) $p = \frac{2q}{3}$

(B) $p = \frac{2}{3q}$

(C) $p = \frac{2\sqrt{q}}{3}$

(D) $p = \frac{2}{3\sqrt{q}}$

- 13 A new brand of lawn food has been developed that promises strong green lawns.

250 residents from two different regions were given the lawn food to test its effectiveness and the results are shown in the following table.

	<i>Lawn food effective</i>	<i>Lawn food not effective</i>	<i>Total</i>
Region A	80	25	105
Region B	105	40	145
	185	65	250

What is the probability that a resident selected at random from Region B did NOT find the lawn food effective?

- (A) 16%
 (B) 26%
 (C) 27.6%
 (D) 61.5%
- 14 $16ab^3 + \frac{2b}{a^3} =$

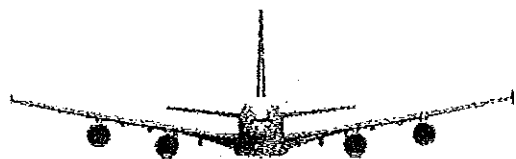
(A) $\frac{a^4b^2}{8}$

(B) $\frac{a^2b^4}{8}$

(C) $8a^4b^2$

(D) $8a^2b^4$

- 15 This large aircraft has 525 people on board (including passengers and crew). Before take-off from Sydney it has 320 000 L of fuel in its fuel tanks.

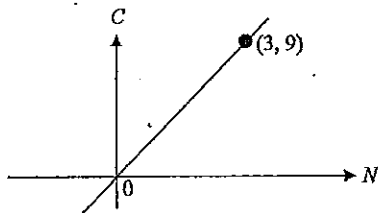


After landing in Dubai, a distance of 12 000 km from Sydney, the aircraft has 36 500 L of fuel remaining in reserve.

What quantity of fuel in litres/100 km did the aircraft use for every person on board?

- (A) 1.5
- (B) 3.0
- (C) 3.75
- (D) 4.5

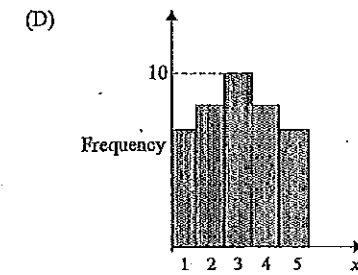
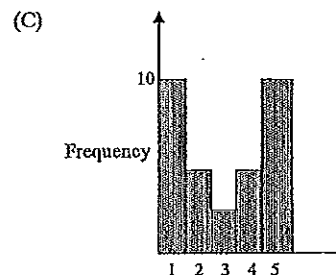
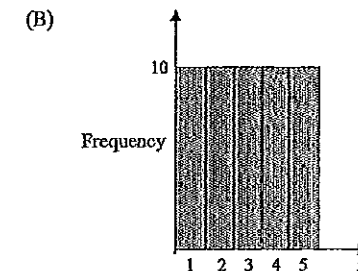
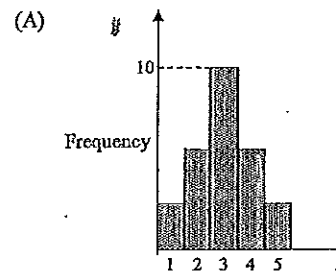
16



What is the equation of the line shown on the graph?

- (A) $N = 9C + 3$
- (B) $C = 3N$
- (C) $C = 6N + 9$
- (D) $N = 3C$

- 17 Which one of the following data distributions has the greatest standard deviation?



- 18 If $4k^2 = 100$, what is the value of $2k^4$?

- (A) 78.125
- (B) 625
- (C) 1250
- (D) 10 000

- 19 Seeds were planted in a controlled environment. The heights of the resulting plants were recorded some weeks later.

The data collected was found to have an interquartile range of 12 cm with a lower quartile of 22 cm.

Which of the following plant heights would be considered an outlier of the data collected?

- (A) 3 cm
- (B) 4 cm
- (C) 35 cm
- (D) 50 cm

- 20 The cost (C) of production of water tanks (T) in a factory is given by the equation:

$$\$C = 800 + 25T$$

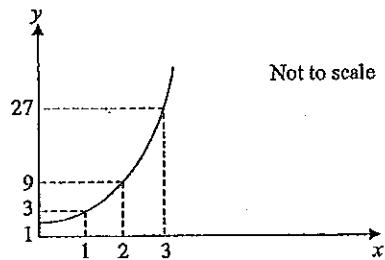
The income (I) received from the sale of these tanks is given by:

$$\$I = 105T$$

Which of the following calculations would correctly give the profit ($\$P$) made from selling 20 tanks?

- (A) $\$P = 80 \times 20 + 800$
 (B) $\$P = 30 \times 20 - 800$
 (C) $\$P = 80 \times 20 - 800$
 (D) $\$P = 105 \times 20 - 300$

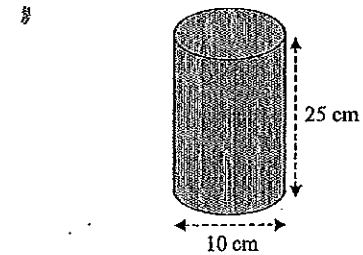
21



Which of the following could be the equation of this graph?

- (A) $y = x^3$
 (B) $y = x^3 + 1$
 (C) $y = 3x^2 + 1$
 (D) $y = 3^x$

- 22 What is the total surface area (in cm^2) of this closed cylinder?



- (A) 175π
 (B) 300π
 (C) 625π
 (D) 700π
- 23 Life expectancy data for men and women was collected from a number of countries in 2012. The trend line for this data was found to be approximated by the equation:

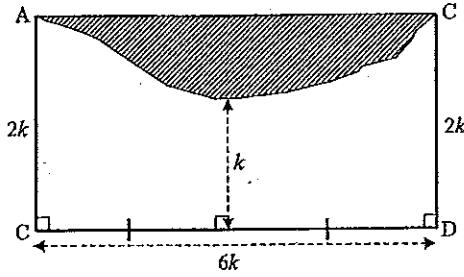
$$y = 0.8x + 9.4$$

where x is the life expectancy of a woman and y is the life expectancy of a man.

Using this equation, approximately how much longer (in years) is a woman expected to live if a man has a life expectancy of 75?

- (A) 5.6
 (B) 7
 (C) 8.6
 (D) 9.6

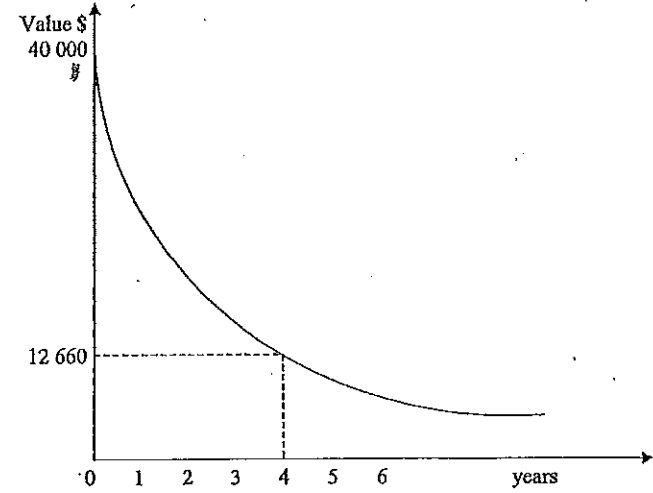
24



Using Simpson's rule, which of the following expressions would give the area of the shaded section in the diagram?

- (A) $4k^2$
- (B) $8k^2$
- (C) $9k^2 + 6k$
- (D) $8k^2 + 6$

25



A car was purchased new for \$40 000.

By applying the declining balance method of depreciation, the value of the car after 4 years, was \$12 660.

What was the approximate annual percentage loss in value of the car over the 4-year period?

- (A) 13.6
- (B) 17
- (C) 18.75
- (D) 25

Section II

75 marks

Attempt Questions 26–30

Allow about 1 hour 55 minutes for this section

Answer the questions in the spaces provided.

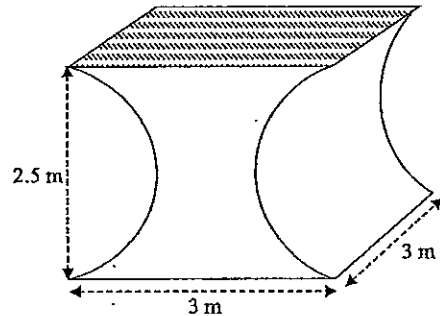
Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on page 30. If you use this space, clearly indicate which question you are answering

Question 26 (15 marks)

Marks

(a) The diagram shows a square-based concrete pillar used for supporting heavy beams.



The pillar has been moulded from a square-based rectangular prism of height 2.5 m so that the sides form semicircular curves along the pillar's length.

(i) What is the radius of the semi-circular sections? 1

.....

(ii) Calculate the area (correct to ONE decimal place) of the front surface of the pillar. 2

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Question 26 continues on the next page

Question 26 (continued)

Marks

(iii) The cost of manufacturing each pillar is based on \$245 per cubic metre of concrete and \$125 delivery for each cubic metre.

What is the total cost of manufacturing and delivering 15 of these pillars? 2

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Question 26 continues on the next page

Question 26 (continued)

Marks

(b) The following table gives the energy consumption of a number of kitchen and laundry appliances used in a household.

Appliance	Energy use	Average number of times appliance is used each week
Refrigerator/freezer	690 kwh/annum	
Dishwasher	0.56 kwh/use	5
Washing machine	0.49 kwh/use	3
Clothes dryer	3.15 kwh/use	2

(i) For what reason would there be no indication of the uses of the refrigerator/freezer? 1

.....

(ii) Calculate the total annual energy use in kilowatt hours (kwh) that the four appliances in this household consume. Give your answer to the nearest kwh. 2

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(iii) The cost of using energy in this household is set at 25.9 cents per kwh.
 What is the average cost per day of using the four appliances? 2

.....

(iv) A salesperson claimed that a larger refrigerator/freezer, with higher energy use of 800 kwh/annum, would add less than 10 cents per day to the household's energy costs.

Do you agree with this claim? Justify your answer with suitable calculations. 1

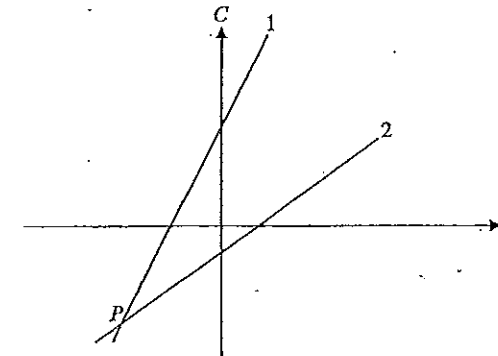
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Question 26 continues on the next page

Question 26 (continued)

Marks

(c) The diagram shows the graphs of the two lines $C = t - 1$ and $C = 2t + 4$.



(i) Match each equation with the numbers 1 and 2 on the diagram. 2

1:

2:

(ii) By solving the equations of the two lines simultaneously, write down the coordinates of P, the point of intersection of the two lines. 2

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Coordinates of P:

End of Question 26

Question 27 (15 marks)

Marks

- (a) Jasmine has a 24-month mobile phone plan and pays \$43 per month that includes an \$8 payment for her phone headset.

Jasmine also pays the charges listed in the following table.

\$35 plan	Rates (for use within Australia)
Standard voice call flag fall	\$0.40
Standard voice call rate	\$0.98 per min
SMS to standard Australian mobiles	\$0.00
MMS to standard Australian mobiles	\$0.55 per message
Video flag fall	\$0.40 per call
Standard video call rate	\$1.25 per min
Excess data usage	\$0.10 per MB
Included in the plan	
Included value	\$200 of standard calls for use within Australia
Included data	1 GB within Australia
Included messages	Unlimited standard national SMS within Australia and overseas

- (i) What is the total cost of a standard 2-minute phone call on this plan? 1

 (ii) Jasmine used 1.2 GB of data last month.
 How much will she pay for excess data usage? 1

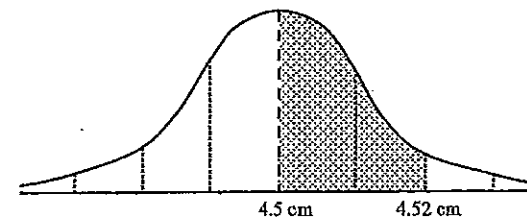
 (iii) In addition to last month's data usage, Jasmine made 75 standard two-minute calls, sent 90 SMS texts and a number of five-minute video calls.
 Jasmine paid a total of \$102.90 last month for her plan.
 How many five-minute video calls did Jasmine make last month? 2

Question 27 continues on the next page

Question 27 (continued)

Marks

- (b) The data recorded for the diameters (in cm) of 200 solid metal cylindrical blocks was found to be normally distributed and illustrated on this bell curve.



- (i) What is the standard deviation of the data recorded? 1

 (ii) Write the Z-scores associated with the two diameters shown. 2
 4.5 cm:
 4.52 cm:
 (iii) How many of the cylindrical blocks would have diameters within the shaded sections of the curve? 2

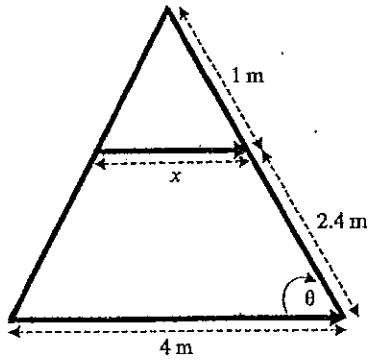
 (iv) Calculate the Z-score for a diameter of 4.484 cm. 2

Question 27 continues on the next page

Question 27 (continued)

Marks

- (c) The diagram shows an A-frame isosceles triangle structure for a timber roof.
A horizontal support beam (parallel to the base of the frame) has length x metres, as shown.



- (i) Calculate the size of the angle represented by θ in the structure. Give your answer to the nearest minute.

2

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- (ii) Use the theory of similar triangles to show that the horizontal support beam has length of approximately 1.2 m.

2

.....

End of Question 27

Question 28 (15 marks)

Marks

- (a) The object (u) and image (v) positions for a lens of focal length f , are related by the formula:

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

How far from the lens is the image when an object is 60 cm in front of a lens of focal length 20 cm?

3

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- (b) Lynette is 20 years old. While in hospital, she is prescribed medicine to be given at a rate of 45 drops per minute.

One drop is equivalent to 0.05 mL.

- (i) What quantity of medicine (mL) would Lynette have been given after 2.5 hours?

2

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- (ii) James is an 18-month-old boy who is prescribed the same medicine.

The quantity of medicine James is to be given can be determined by use of Young's Rule:

$$\text{child dosage} = \frac{\text{age (of child in years)} \times \text{adult dosage}}{\text{age (of child in years)} + 12}$$

Using the data on Lynette's dosage and the formula above, how many drops per minute should James be given?

3

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Question 28 continues on the next page

Question 28 (continued)

Marks

- (c) A formula for estimating a female's blood alcohol content (BAC) is given by:

$$BAC = \frac{10N - 7.5H}{5.5M}$$

Where: N is the number of standard drinks consumed
 H is the number of hours drinking
 M is the person's mass (kg)

- (i) Louisa has a mass of 54 kg and has been drinking alcohol for the last 3 hours.

Her BAC is now estimated to be 0.06.

How many standard drinks has Louisa consumed during this period of time?

3

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- (ii) One standard drink contains 10 g of alcohol. Louis's body can break down alcohol at the rate of 8.5 g/h.

If Louisa stops drinking alcohol now, after how many more hours and minutes (to the nearest minute) should Louisa's BAC be close to zero?

2

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- (iii) Louisa began drinking at 6:30 pm and wants to know at what time her BAC could approach zero.

Based on the above calculations, what is the earliest time that Louisa's could approach zero?

2

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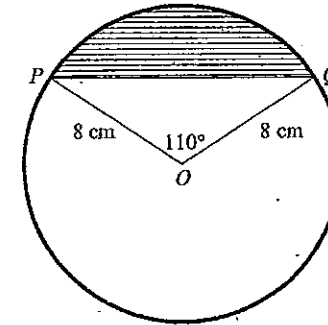
End of Question 28

Question 29 (15 marks)

Marks

- (a) The points P and Q are on the circumference of the circle so that angle $POQ = 110^\circ$.

P is joined to Q to form triangle POQ and a segment is shaded.



- (i) Calculate the length of PQ to the nearest centimetre.

3

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- (ii) Calculate the area of the sector POQ correct to ONE decimal place.

2

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- (iii) Calculate the area (to ONE decimal place) of the shaded segment.

3

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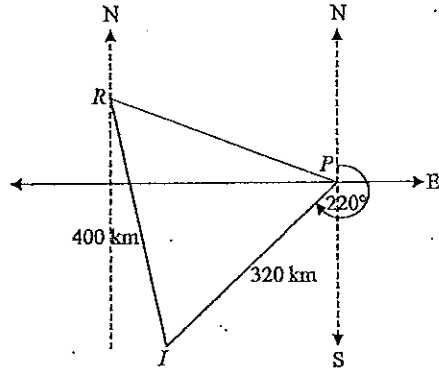
Question 29 continues on the next page

Question 29 (continued)

Marks

- (b) A cruise ship leaves from a port P and heads on a bearing of 220° toward an island resort (I), 320 km from the port.

From the island resort, the ship then travels to another resort R , 400 km from I , before returning to P .



- (i) What is the bearing of the port P from the island resort?

1

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- (ii) Calculate the distance (to ONE decimal place) that the ship travelled West, from P to I .

2

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.....

- (iii) The ship travels from R , back to P , on a bearing of 100° .

What is the size of the acute angle IRP , to the nearest degree?

4

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End of Question 29

Question 30 (15 marks)

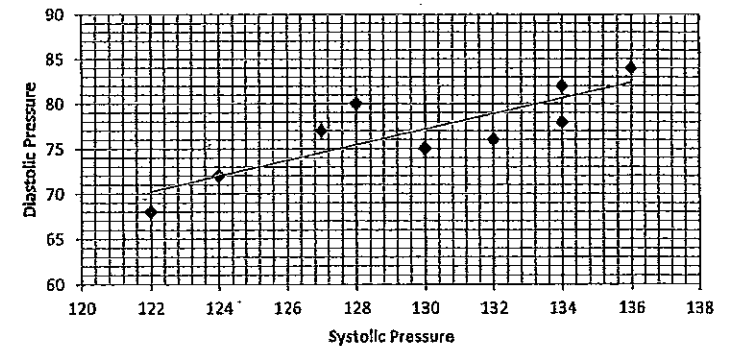
- (a) When a person's blood pressure is measured, both the systolic (maximum) pressure and the diastolic (minimum) pressure are recorded.

The table below shows the blood pressure readings of a person (measured in millimetres of mercury), taken over a period of 9 consecutive weeks.

Reading number	Systolic pressure (s)	Diastolic pressure (d)
1	128	80
2	132	76
3	122	68
4	130	75
5	134	78
6	124	72
7	134	82
8	136	84
9	127	77

The data in the table is shown on a scatterplot below with the least squares line of best fit drawn.

Blood Pressure Readings



Question 30 continues on the next page

Question 30 (continued)

Marks

- (i) The correlation coefficient (r) for this data is 0.84.

Describe the strength of the relationship between the systolic and diastolic pressure readings.

1

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- (ii) The mean and standard deviation of the person's *systolic* pressure were:

Mean = 129.7 Standard deviation = 4.5

Calculate the mean and standard deviation for the person's *diastolic* pressure (correct to ONE decimal place).

2

Mean:
 Standard deviation:

- (iii) Using the formula sheet, determine the equation of the *least squares line of best fit* for the data on the scatterplot.

4

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- (iv) During the 10th week, the person's systolic blood pressure reading was recorded as 138.

Use the equation from part (iii) to calculate the person's diastolic pressure and comment on any restrictions this equation has for predicting the person's future diastolic readings.

2

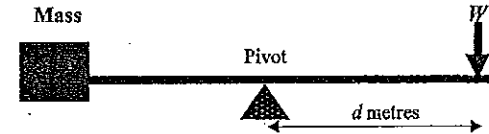
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Question 30 continues on the next page

Question 30 (continued)

Marks

- (b) To balance a mass at the end of a plank, a weight (W) in kilograms, is placed on the other side of the pivot point.



The weight that needs to be placed to balance the mass, varies inversely with the distance (d) it is from the pivot point. It is given by:

$$W = \frac{k}{d} \quad \text{where } k \text{ is constant}$$

A young boy weighs 26 kg. He is sitting at the end of the plank, 1.5 m from the pivot.

The boy's father weighs 75 kg.

By using the above formula, determine how far from the pivot on the other end, the boy's father has to sit, so that he balances the plank.

Give your answer correct to TWO decimal places.

3

.....

Question 30 continues on the next page

General Mathematics

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

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

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

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 a 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:

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

**NSW INDEPENDENT TRIAL EXAMS – 2014
MATHEMATICS GENERAL 2- HSC TRIAL EXAM
MARKING GUIDELINES**

Section I

Question	Answer	Assessed Outcome	Band
1.	C	FSRe2, MM1, MGP5	2
2.	A	FM11, MGP6	2
3.	A	AM4, MG2H-3	2
4.	B	AM1, MGP3	3
5.	B	MM2, MGP4	3
6.	C	MM6, MG2H-4	3
7.	D	PB2, MG2H-8	3
8.	C	FM5, MG2H-6	3
9.	B	MM1, MGP3	3
10.	D	DS2, MGP7	3
11.	C	PB2, MG2H-8	4
12.	D	AM3, MG2H-9	4
13.	C	PB2, MG2H-2	3
14.	C	AM3, MG2H-9	3
15.	D	MM1, MGP4	3
16.	B	AM2, AM4, MGP2	3
17.	C	DS4, MG2H-2/7	4
18.	C	AM3, MG2H-3	4
19.	A	DS4, MG2H-2	4
20.	C	AM4, MG2H-3	4
21.	D	AM5, MG2H-3	4
22.	B	MM4, MG2H-4	4
23.	B	FSHe3, MG2H-2/7	5
24.	A	MM4, MG2H-4/5	5
25.	D	FSDr2, MGP-2/3	6

**Section II
Question 26**

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	$2.5 + 2 = 1.25 \text{ m}$	1	MM2, MGP-4	2
(a)(ii)	Area = $(3 \times 2.5) - \pi(1.25)^2$ $= 2.6 \text{ m}^2$	1 1	MM2, MGP-4	3
(a)(iii)	Volume of pillar = AH $= 2.6 \times 3 \text{ m}^3$ $= 7.8 \text{ m}^3$ Total cost (\$) = $15(7.8 \times (245 + 125))$ $= 15(2886)$ $= 43\,290$	1 1	MM2, MGP-4	3
(b)(i)	The refrigerator would always be turned on and always using energy	1	FSRe3, MG2H-2/10	2
(b)(ii)	Total $\text{kwh} = 690 + (0.56 \times 5 \times 52) + (0.49 \times 3 \times 52)$ $+ (3.15 \times 2 \times 52)$ $= 1240 \text{ kwh}$	2	FSRe3, MG2H-2/10	3
(b)(iii)	Average cost/day = $\$(1240 \times 0.259) + 365$ $= \$0.88$	2	FSRe3, MG2H-2	3
(b)(iv)	The household would use an extra 110 kwh/annum Cost of this is $110 \times \$0.259$ $= \$28.49$ per annum $= 7.8$ cents per day The salesperson gave correct information	1	FSCo1, MG2H-10	3
(c)(i)	1: $C = 2t + 4$, 2: $C = t - 1$	2	AM2, MGP3	2
(c)(ii)	$C = t - 1 \dots (A)$ $C = 2t + 4 \dots (B)$ (B) - (A): $0 = t + 5$ $t = -5$ In (A), $C = -6$ Solution: P: $(-5, -6)$	1 1	AM2, MGP-3/ AM4, MG2H-9	4

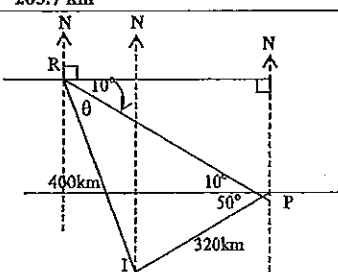
Question 27

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	$(2 \times \$0.98) + \$0.40 = \$2.36$	1	FSCo1, MGP-6	2
(a)(ii)	Excess usage = \$0.10/MB Allowance is 1 GB = 1000 MB Hence, excess usage is 200 MB Cost = $200 \times \$0.10 = \20	1	FSCo1, MGP-8	2
(a)(iii)	75 standard 2 min calls = $75 \times \$2.36 = \177 (no cost) 90 SMS messages: no cost 5 min video calls: cost = $\$1.25/\text{min} + \$0.40/\text{call} = \$6.65$ Hence: $\$102.90 = \text{plan cost} + \text{excess data usage} + \text{video calls}$ $\$102.90 = \$43 + \$20 + \$6.65n$ $\$6.65n = \39.90 $n = 6$ (6/5 min video calls were made)	1	FSCo1, MGP-6, MGP-8	4
(b)(i)	Standard deviation = $(4.52 - 4.5) \div 2 = 0.01$	1	DSS, MG2H-2	2
(b)(ii)	4.5 cm: Z score 0, 4.52 cm: Z score 2	2	DSS, MG2H-2	2
(b)(iii)	$(34\% + 13.5\%)$ of 200 = 47.5% of 200 = 95	1	DSS, MG2H-7	4
(b)(iv)	$Z = \frac{x - \bar{x}}{\frac{SD}{\sqrt{n}}}$ $= \frac{4.484 - 4.5}{\frac{0.01}{\sqrt{297}}}$ $= -1.6$	2	DSS, MG2H-7	4
(c)(i)	$\cos \theta = \frac{2}{3.4}$ $= 0.5882$ $\theta = 53^\circ 58'$	1	MM3, MGP-4	4
(c)(ii)	$\frac{x}{4} = \frac{1}{3.4}$ $x = 4 \div 3.4$ $= 1.2 \text{ m}$	1	MM3, MGP-5	4

Question 28

Part	Answer	Marks	Outcome Assessed	Band
(a)	$\frac{1}{u} + \frac{1}{v} = \frac{1}{20} + \frac{1}{v} + \frac{1}{20}$ $\frac{1}{v} + \frac{1}{20} = \frac{1}{10}$ $\frac{1}{v} = \frac{1}{10} - \frac{1}{20} = \frac{1}{20}$ $v = 20$	1 1 1	AM3, MG2H-9	5
(b)(i)	45 drops/min = $45 \times 0.05 \text{ mL/min}$ = 2.25 mL/min Quantity = $2.25 \times 150 \text{ min}$ = 337.5 mL	1	FSh2, MG2H-5	3
(b)(ii)	Lynette: 45 drops/min = 2.25 mL/min James: dosage = $\frac{1.5 \times 2.25}{1.5 + 12}$ = 0.25 mL Now 2.25 mL = 45 drops/min $0.25 \text{ mL} = \frac{45}{2.25} \times 0.25$ = 5 drops/min	1 1 1	FSh2/ MG2H-5	5
(c)(i)	$0.06 = \frac{10N - 7.5(3)}{5.5 \times 54}$ $= \frac{10N - 22.5}{297}$ $17.82 = 10N - 22.5$ $10N = 40.32$ $N = 4.3$ Louise has had 4 drinks	1 1 1	FSDr3, MGP-5/8	5
(c)(ii)	4 standard drinks = 40 g of alcohol Number of hours to reduce BAC = $\frac{40}{8.5}$ = 4.7 i.e., another 4 hours and 42 min	1 1	FSDr3, MGP-5/8	4
(c)(iii)	Louisa stopped drinking at 9:30 pm 9:30 pm + 4 hours 42 mins Approx. at 2:12 am the next morning	2	FM5, H1, H2	4

Question 29

Part	Answers	Marks	Outcome Assessed	Band
(a)(i)	$PQ^2 = 8^2 + 8^2 - (2 \times 8 \times 8 \times \cos 110^\circ)$ $= 171.77858$ $PQ = 13 \text{ cm (to the nearest cm)}$	1 1 1	MM5, MG2H-5	5
(a)(ii)	Area = $\frac{110}{360} \times \pi \times 8^2$ $= 61.4 \text{ cm}^2$	1 1	MM4, MG2H-5	4
(a)(iii)	Area of segment = area of sector - area Δ $= 61.4 - (0.5 \times 8 \times 8 \times \sin 110^\circ)$ $= 31.3 \text{ cm}^2$	1 1 1	MM4, MM5 MG2H-5	5
(b)(i)	040°	1	MM5, MG2H-5-10	5
(b)(ii)	$\cos 50^\circ = \frac{x}{320}$ $x = 320 \times \cos 50^\circ$ $= 205.7 \text{ km}$	1 1	MM3, MM5, MGP4, MG2H-5	5
(b)(iii)	 <p>Using the sin rule: $\frac{\sin \theta}{320} = \frac{\sin 60^\circ}{400}$ $\sin \theta = \frac{320 \times \sin 60^\circ}{400}$ $= 0.6928$ $\theta = 44^\circ \text{ to the nearest degree}$</p>	1 1 1	MM5, MG2H-4	6

Question 30

Part	Answer	Marks	Outcome Assessed	Band
(a)(i)	The correlation of 0.84 indicates a strong positive relationship between the systolic and diastolic blood pressures	1	FSHe1, MG2H-1/2/5/7	4
(a)(ii)	Mean = 76.9, Standard dev: 4.7	2	DS4, MG2H-9	5
(a)(iii)	Let S be Systolic (x -axis) and D be diastolic (y -axis) Using $D = \text{gradient} \times S + D \text{ intercept}$ Now gradient = $r \times \frac{\text{standard deviation of } D}{\text{standard deviation of } S}$ $= 0.84 \times \frac{4.7}{4.5}$ $= 0.88 \text{ (2 dec. pl.)}$ $D \text{ intercept: } \bar{D} - (\text{gradient} \times \bar{S})$ $= 76.9 - (0.88 \times 129.7)$ $= -37.2$ Hence equation of least squares line of best fit: $D = 0.88S - 37.2$	1 1 1 1	FSHe1, MG2H-7 MG2H-9	6
(a)(iv)	Let $S = 138$ Then $D = 0.88(138) - 37.2$ $= 84.24$ Since the correlation is high and there is a direct variation between the systolic and diastolic pressure, the predicted reading of $D = 84.24$ is consistent with the other readings. However a person's blood pressure is dependent on many factors and this least squares equation can only be used for estimates within the data recorded. It is not feasible to suggest it could be used for all systolic pressures.	1 1	FSHe1, MG2H-10	6
(b)	$W = \frac{k}{d}$ Let $W = 26$, and $d = 1.5$ Then $26 = \frac{k}{1.5}$ $k = 1.5 \times 26$ $= 39$ Now let $W = 75$: so $75 = \frac{39}{d}$ $d = 39 \div 75$ $= 0.52 \text{ m}$ Thus, the father must sit 0.52 m from the pivot in order to balance his son's weight	1 1 1	AM3, MG2H-3	6
(c)	Square-based box has dimensions: $(200 - 2x) \times (200 - 2x) \text{ cm}$ Perimeter of base = $4(200 - 2x) \text{ cm}$ $= (800 - 8x) \text{ cm}$ $= 8(100 - x) \text{ cm}$ $= \frac{8(100 - x)}{25} \text{ metres}$ $= \frac{100}{25} \text{ metres}$ $= \frac{2(100 - x)}{25} \text{ metres}$	1 1 1	AM3, MG2H-3	6