

NSW INDEPENDENT SCHOOLS

2015  
Higher School Certificate  
Trial Examination

# General Mathematics

## 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 2–16  
25 marks

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

Section II – Pages 17–32  
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

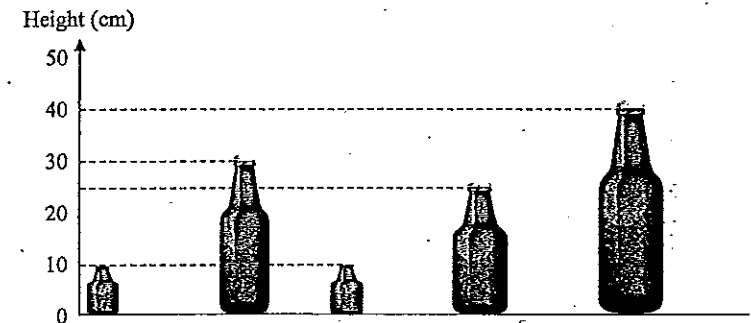
STUDENT NUMBER/NAME: .....

- 1 Megan has used 3.15 GB of her computer's hard drive storage space for her music files, which average 8.7 MB each. (1 GB=1024 MB)

Approximately how many music files does Megan have stored on her computer?

- (A) 362  
(B) 371  
(C) 2806  
(D) 3796

- 2 Which statement about the 5 similar bottles is correct?

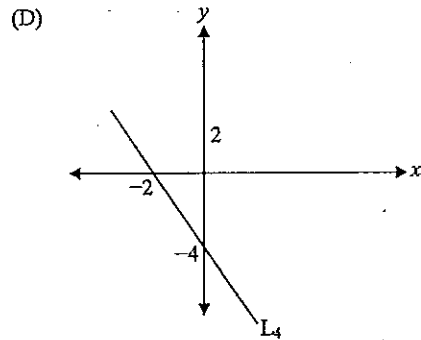
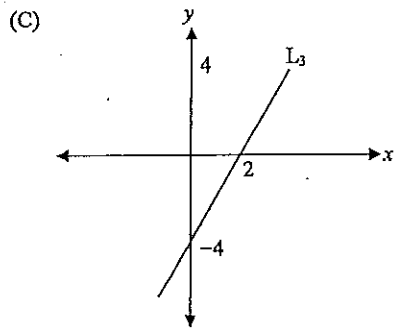
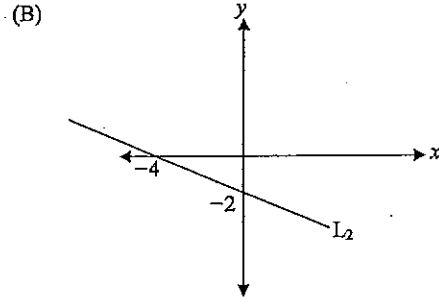
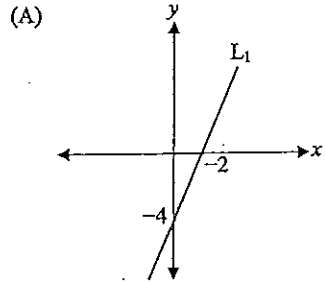


- (A) The mode height is 40 cm.  
(B) The median height is 10 cm.  
(C) The range in height is 20 cm.  
(D) The mean height is 23 cm.

- 3 A volume of 2.5 cubic metres is equivalent to how many cubic centimetres?

- (A)  $2.5 \times 10^2$   
(B)  $2.5 \times 10^4$   
(C)  $2.5 \times 10^6$   
(D)  $2.5 \times 10^8$

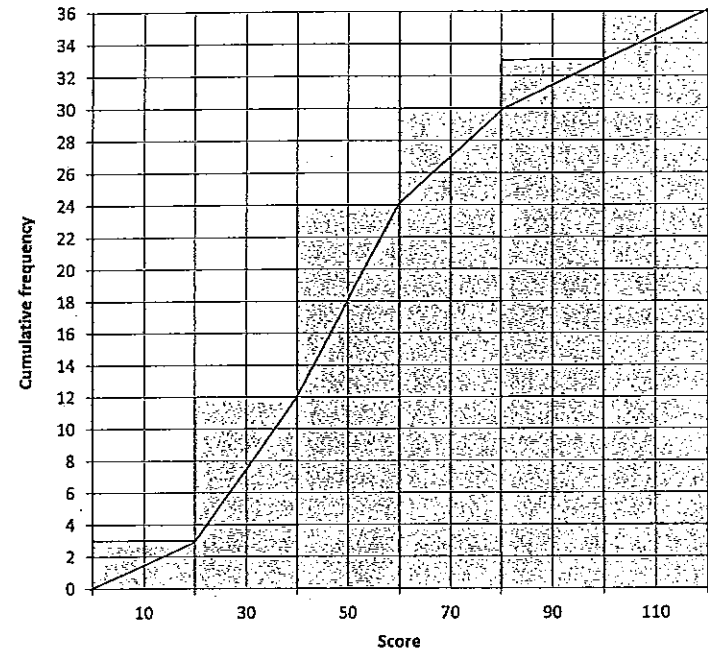
4 Which of the lines shown in the diagrams has equation  $y = -2x - 4$ ?



5  $(4a)^2 + 3a^2 = ?$

- (A)  $7a^2$
- (B)  $11a^2$
- (C)  $19a^4$
- (D)  $19a^2$

6 A cumulative frequency histogram and polygon for some collected data are shown below.

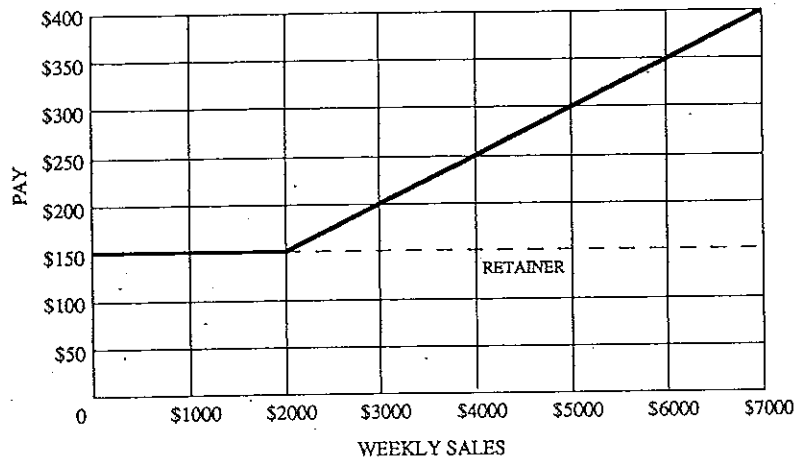


What is the upper quartile for the collected data?

- (A) 27
- (B) 36
- (C) 70
- (D) 90

7 The graph shows the payment that employees of a company receive each week.

The weekly pay is based on a retainer plus commission on sales.



What percentage commission do employees of this company receive on their sales?

- (A) 2.5
- (B) 3.5
- (C) 5
- (D) 7.5

8 A swimming pool pump operating every day of the year uses energy at the rate of 750 kwh per year.

The cost to run this pump is \$70 per year.

What is the approximate average cost per kwh to run this pump?

- (A) \$0.02
- (B) \$0.09
- (C) \$0.19
- (D) \$0.39

9 A survey of Year 12 students at a local high school was conducted with regard to their further education choices for the following year.

The table shows the number of students who indicated in the survey that they either wish to study at a TAFE college or at University.

Survey results

	TAFE/College	University	Total
Male	66	16	82
Female	42	12	54
	108	28	136

A student is selected at random from the surveyed group.

What is the probability (to the nearest percentage) that the student selected is a male who has indicated that he intends to study at a TAFE/College next year?

- (A) 49%
- (B) 60%
- (C) 61%
- (D) 80%

10 The sum of the numbers represented by  $a$ ,  $b$ ,  $c$  and  $d$  is 42.

If the mean of  $a$ ,  $b$  and  $d$  is 12, what is the value of  $c$ ?

- (A) 6
- (B) 10
- (C) 14
- (D) 18

- 11 The life expectancy of a child born has been recorded every 20 years since 1800.

The table shows the recorded data.

<i>Years since 1800</i>	<i>Life expectancy</i>
0	52
20	52
40	53
60	53
80	55
100	60
120	63
140	63
160	67
180	72
200	82

How much longer (in years) would a child born in 1980 expect to live than a child born in 1880?

- (A) 5  
 (B) 17  
 (C) 60  
 (D) 72
- 12 The results from a recent assessment task were found to be normally distributed.

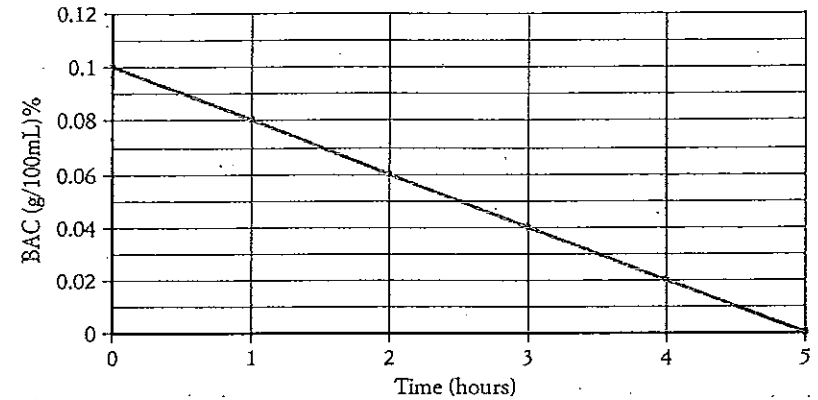
The table shows some results of three students who sat the assessment task.

	<i>Assessment result %</i>	<i>Z-Score</i>
Katie	52	-1
Isaac		1.5
Ashley	80	2.5

What was Isaac's assessment result?

- (A) 60  
 (B) 64  
 (C) 72  
 (D) 74

- 13 This graph shows the approximate decrease per hour in an average person's blood alcohol content (BAC) after they have stopped drinking.

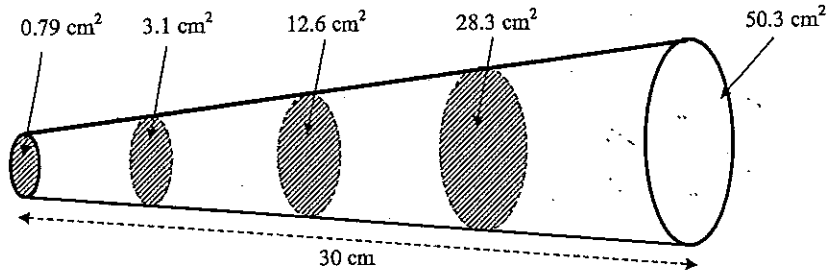


Samantha has been drinking alcohol and at 9:00 pm calculates that her BAC is 0.045.

If Samantha stops drinking at 9:00 pm, at approximately what time, according to the graph, should her BAC reach zero?

- (A) 10:15 pm  
 (B) 10:30 pm  
 (C) 10:45 pm  
 (D) 11:15 pm

- 14 A clear plastic container has a circular opened top end and tapers to a smaller circular base, as shown in the diagram below.



A number of circular cross sections at equal distances along the length of the container are shown with areas calculated.

By using Simpson's rule, what is the approximate volume (in  $\text{cm}^3$ ) of the plastic container?

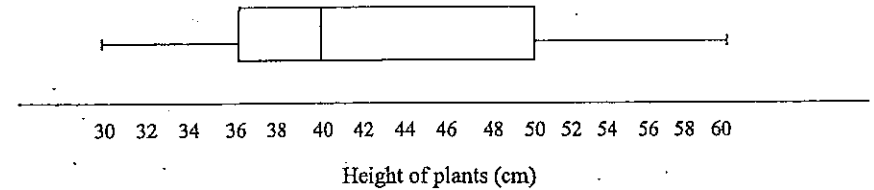
- (A) 200
  - (B) 435
  - (C) 505
  - (D) 2020
- 15 The cost ( $C$ ) of manufacturing steel beams is given by  $\$C = 1350 + 300n$  where  $n$  is the number of beams.

The income ( $I$ ) resulting from the sale of these beams is  $\$I = 525n$ .

What is the least number of beams that must be sold in order that a profit be made?

- (A) 2
- (B) 5
- (C) 6
- (D) 7

- 16 The heights of the plants which grew from a packet of seeds were recorded in a box-and-whisker plot.



Which of these statements about the recorded data is true?

- (A) There were more plants with heights over 50 cm than under 36 cm.
  - (B) The mode, median and mean are all 40.
  - (C) The data recorded suggests that the heights were negatively skewed.
  - (D) If there were 60 plants with heights below 50 cm then there were 20 plants with heights over 50 cm.
- 17 A bag has a number of cards, identical in size, with either the number 1, 2, 5 or 10 written on them.

The table shows how many cards with these numbers are in the bag.

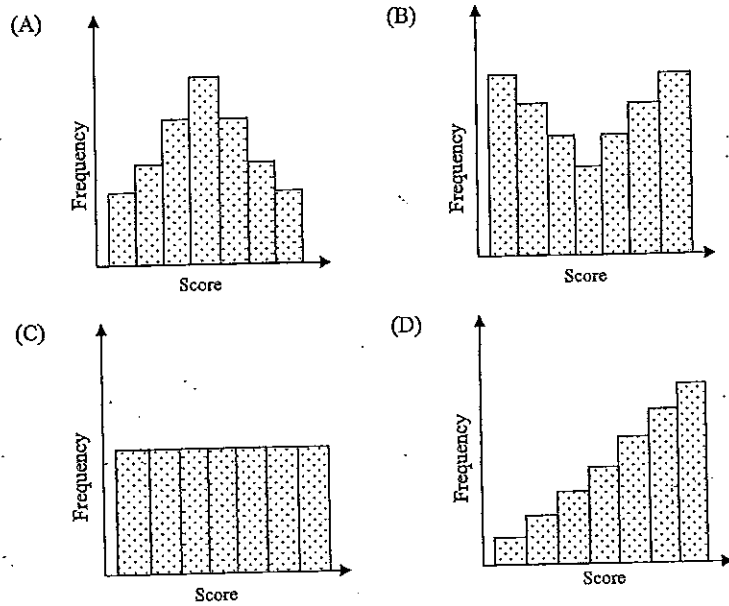
Number on card	Number of cards
1	10
2	8
5	6
10	1

A card with the number 5 on it is randomly drawn from the bag and not replaced.

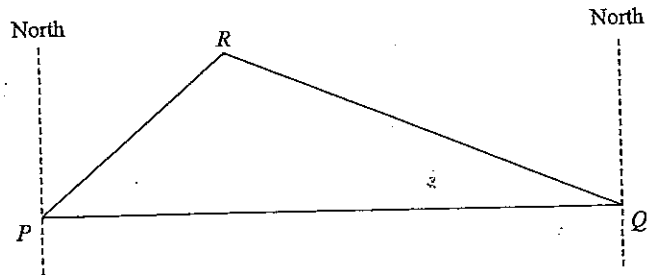
If a second card is randomly drawn from the bag, what is the probability that the sum of the numbers on the two cards will be less than 10?

- (A)  $\frac{3}{4}$
- (B)  $\frac{24}{25}$
- (C)  $\frac{23}{72}$
- (D) 1

18 Which of the graphs shows data with the largest standard deviation?



19 Town Q is due East of Town P in the following diagram.



The bearing of town R from town P is  $050^\circ$  and the bearing of town Q from town R is  $120^\circ$ .

What is the size of angle  $PRQ$ ?

- (A)  $90^\circ$
- (B)  $110^\circ$
- (C)  $120^\circ$
- (D)  $135^\circ$

20 A luxury car was purchased new for \$120 000.

By applying the declining balance method of depreciation, the salvage value  $S$ , of the car, at the end of  $n$  years of use, is given by the equation:

$$S = 120\,000(0.825)^n$$

What was the loss in value of the car during the third year of its use?

- (A) \$3675
- (B) \$14 293
- (C) \$17 325
- (D) \$38 325

21 A formula for converting a dosage of medicine in stock form to the volume *required* for a prescription is:

$$\text{Volume required (mL)} = \frac{\text{Strength required (mg)}}{\text{Stock strength (mg)}} \times \text{Volume of stock (mL)}$$

Patrick was given 50 mL of a prescription medicine which was converted from the stock form.

If the stock form contained 150 mg in 5 mL, how many milligrams of this medicine was Patrick prescribed if the above formula was used?

- (A) 6
- (B) 15
- (C) 20
- (D) 1500

- 22 The table gives statistics for two sets of recorded data.

Data set (x)	$\bar{x}$	172.5
	$s_x$	8.25
Data set (y)	$\bar{y}$	62.25
	$S_y$	0.55
Correlation coefficient (r)	0.95	

What is the equation of the least squares line of best fit for the data sets based on the statistics?

- (A)  $y = 0.063x + 51.38$   
 (B)  $y = -0.63x + 46.4$   
 (C)  $y = -0.063x - 10.87$   
 (D)  $y = 0.45x - 51.38$
- 23 The formula for the area of an annulus is given by  $A = \pi(R^2 - r^2)$ .

Which of the following correctly gives this formula with "r" as the subject?

- (A)  $r = \sqrt{R^2 - \frac{A}{\pi}}$   
 (B)  $r = \sqrt{R^2 + \frac{A}{\pi}}$   
 (C)  $r = R - \sqrt{\frac{A}{\pi}}$   
 (D)  $r = \sqrt{\frac{A}{\pi}} - R$

- 24 A game is played involving a small ball, which is thrown randomly onto a board and lands on one of the numbers from 0 to 16.

Any amount of money can be bet on the ball landing on either a white number or a black number.

				0	
1	2	3	4		White
5	6	7	8		
9	10	11	12		Black
13	14	15	16		

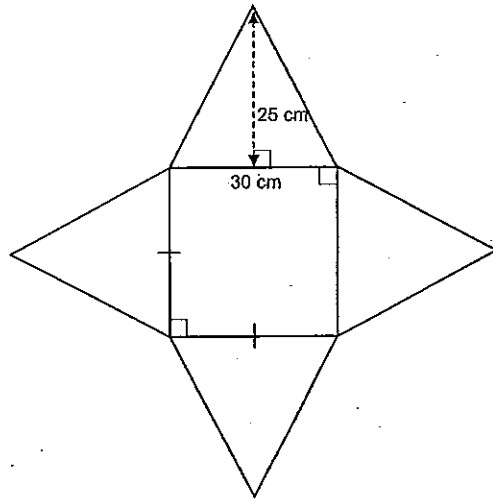
Kaylene places a \$6.80 bet on the ball landing on a black number.

If the ball lands on a white number Kaylene loses her \$6.80.

If the financial expectation of this game is  $-\$3.20$ , what amount would Kaylene win, if the ball lands on a black number?

- (A) \$8.50  
 (B) \$10.00  
 (C) \$11.60  
 (D) \$15.30

25 A container is to be made from this net.



Each of the 4 identical isosceles triangles has a height of 25 cm and a base of 30 cm.

What is the capacity (in litres) of this container?

- (A) 4
- (B) 5
- (C) 6
- (D) 7.5

**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 32. If you use this space, clearly indicate which question you are answering.

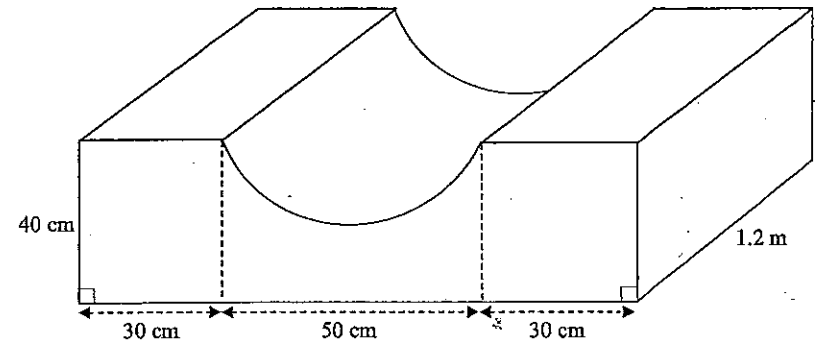
Question 26 (15 marks)

Marks

(a) A piece of foam rubber of length 1.2 m is used for packing.

The cross-section of the foam is a rectangle with a semicircular section cut out, as shown.

NOT TO SCALE



Question 26 continues on the next page.



Question 26 (continued)

Marks

(i) What is the length of the radius of the semicircle? 1

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(ii) Calculate the volume (in cubic metres correct to TWO decimal places) of the semicircular cut out. 2

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(iii) Calculate the volume (in cubic metres correct to TWO decimal places) of the piece of foam packaging. 2

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(b) The surface area ( $S$ ) of a closed cylinder is given by  $S = 2\pi r^2 + 2\pi rh$  where  $r$  is the radius and  $h$  is the height.

(i) Calculate the surface area of a closed cylinder with radius 5 cm and height 20 cm. (Give your answer correct to TWO decimal places). 2

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(ii) Calculate the difference in surface area of this cylinder if the top surface was removed. (Give your answer correct to TWO decimal places). 1

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(iii) If both the top and bottom surfaces of this cylinder were removed, what is the total percentage loss in surface area, compared to the original cylinder? (Give your answer to the nearest percent). 2

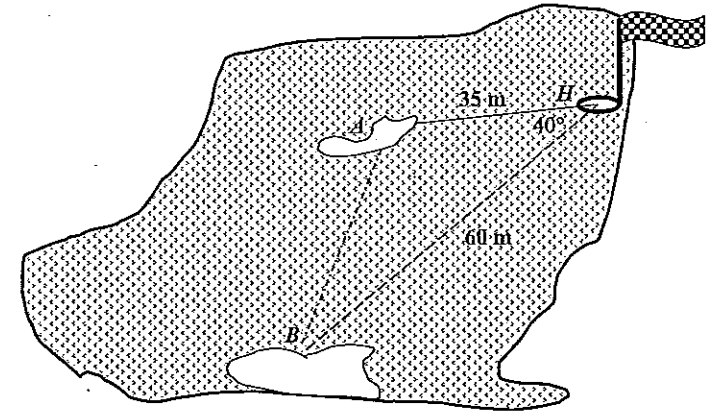
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Question 26 continues on the next page

Question 26 (continued)

Marks

(c)



The two bunkers  $A$  and  $B$  (on level ground) on a golf course are 35 metres and 60 metres respectively from the hole at  $H$ .

The angle  $AHB$  is  $40^\circ$ .

(i) Calculate the area of the triangular section  $ABH$  to the nearest square metre. 2

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(ii) Calculate the distance between the two bunkers at  $A$  and  $B$  to the nearest metre. 3

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End of Question 26

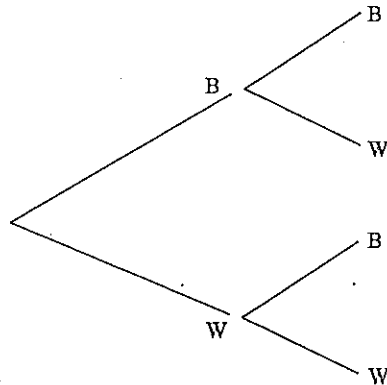
**Question 27 (15 marks)**

**Marks**

(a) A box has 5 blue (B) and 3 white (W) discs, all identical in size.

One disc is randomly selected from the box, kept out, and a disc of the other colour is put in the box in its place.

The tree diagram for two random selections from the box is shown below.



(i) Complete the tree diagram by writing in the probabilities on all branches. 2

(ii) What is the probability that two discs of different colours will be randomly selected? 3

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(iii) What is the probability that at least one blue disc will be selected from the box? 2

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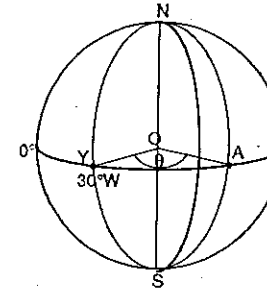
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Question 27 continues on the next page

**Question 27 (continued)**

**Marks**

(b) Two cities *A* and *Y* are located on the equator, as shown in the diagram of the Earth's surface.



(i) Write down the co-ordinates of city *Y*. 1

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(ii) The distance between city *Y* and city *A* is approximately 5 000 km.

Show that  $\theta$  (angle *AOY*) is approximately  $45^\circ$ . (Use the radius of the Earth as 6400 km). 3

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(iii) Write down the co-ordinates of city *A*. 1

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(iv) A plane takes off in city *Y* at 9:15 am local time with city *A* as its destination.

If the plane travels at an average speed of 625 km/hr, at what local time will it touch down in city *A* (assuming its flight path is along the equator)? 3

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End of Question 27

Question 28 (15 marks)

Marks

(a) Metal rods are manufactured with a mean length of 6.25 cm and standard deviation of 3 mm.

(i) What Z-score corresponds to a rod length of 5.65 cm?

1

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(ii) What length rod corresponds to a Z-score of 1.25?

1

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(iii) A batch of 1500 rods is delivered to a factory where they are to be used as parts in a machine.

Rods that have lengths less than 5.65 cm or greater than 7.15 cm do not meet the factory's requirements.

Approximately how many rods from the batch would be unsuitable for use by the factory?

3

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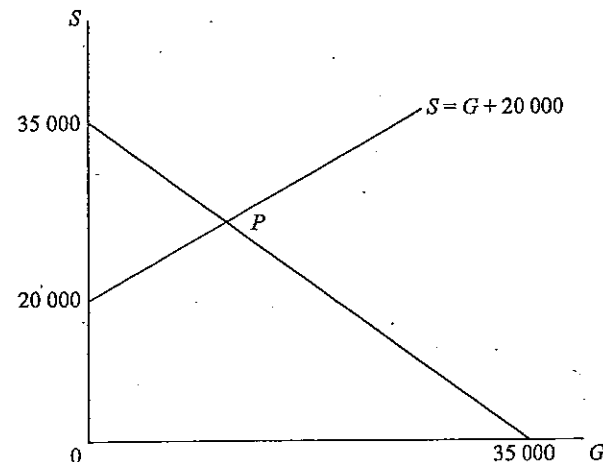
Question 28 continues on the next page

Question 28 (continued)

Marks

(b) A company has manufactured a number of silver ( $S$ ) and a number of gold ( $G$ ) commemorative medals to celebrate a particular sporting event.

The graph conveys information regarding the number of medals produced for the event.



(i) One of the lines on the graph has equation  $S = G + 20\,000$ .

Explain what this equation conveys about the production of medals.

1

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(ii) Write down the equation of the second line shown on the graph.

2

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(iii) In terms of the production of medals, explain what  $P$  represents.

1

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Question 28 continues on the next page

Question 28 (continued)

Marks

- (iv) By solving the equations of the two lines simultaneously, determine the number of gold medals produced for the sporting event.

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- (v) When the medals were first sold, the price of the gold medals was \$550. After 5 years, the value of the medals had increased to \$725.

By using the formula  $FV = PV(1 + r)^n$ , determine the annual percentage increase in value of these gold medals. (Give your answer correct to one decimal place).

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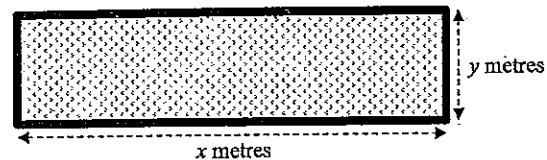
End of Question 28

Question 29 (15 marks)

Marks

- (a) Farmer Jenkins wants to enclose some of his animals using 160 linear metres of fencing.

Farmer Jenkins initially draws a plan of a rectangular enclosure, as shown, and marks the length  $x$  metres and width  $y$  metres.



- (i) Write down one possible value of each of  $x$  and  $y$  that Jenkins could write on the plan.

1

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- (ii) Show that  $y = 80 - x$ .

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Question 29 continues on the next page

Question 29 (continued)

Marks

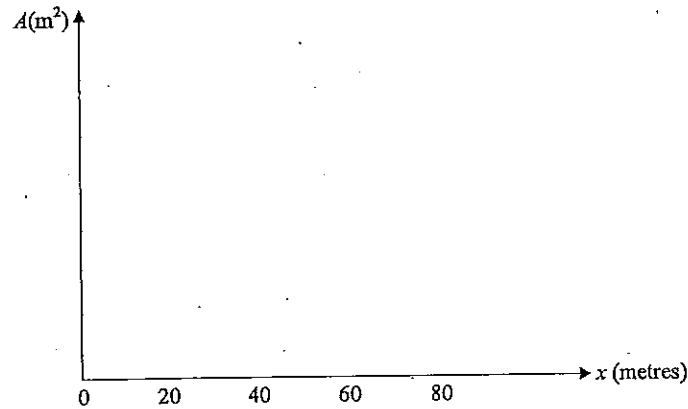
(iii) Jenkins writes an equation for the area ( $A$ ) of the enclosure as:

2

$$A = 80x - x^2$$

$$= x(80 - x)$$

On the axes below, draw a sketch of the graph represented by this equation using the values of  $x$  given. Show the corresponding  $A$  values on the vertical axis.



(iv) Using the graph, determine the dimensions of the enclosure that will give the maximum area.

2

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(v) What conclusion can be drawn from the graph?

1

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Question 29 continues on the next page

Question 29 (continued)

Marks

(vi) Suppose  $L$  linear metres are to be used to enclose a pen.

If the pen is to have maximum area ( $A$ ), use the above conclusion to show that:

$$A = \frac{L^2}{16}$$

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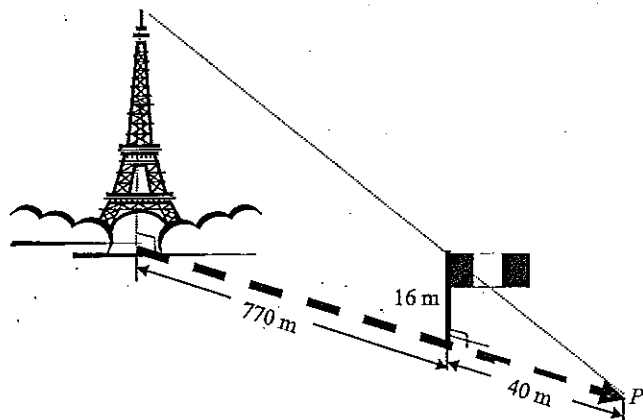
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Question 29 continues on the next page

Question 29 (continued)

Marks

- (b) The French flag is on a 16 metre pole perpendicular to the ground at a position 770 metres from the foot of the Eiffel Tower in Paris. The ground is level.



At night, a light beam shines from the top of the tower and reaches a point P along the ground, 40 metres from the flag pole.

- (i) Show that the height of the tower is 324 metres tall. 3

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- (ii) What is the angle of depression (to the nearest degree) from the top of the tower to the bottom of the flag pole? 2

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End of Question 29

Question 30 (15 marks)

- (a) Jackson has a personal loan of \$15 000 and has to repay this loan in equal monthly payments over 4 years. The interest rate on Jackson's loan is 7.8% pa.

The following table shows the present value interest factors for reducing balance loans at various *monthly* interest rates (*r*) over different time periods (*N*).

Table of present value interest factors

<i>r</i>	0.0060	0.0065	0.0070	0.0075	0.0080	0.0085
<i>N</i>						
45	39.33406	38.90738	38.48712	38.07318	37.66545	37.26383
46	40.09350	39.64965	39.21263	38.78231	38.35859	37.94133
47	40.84841	40.38714	39.93310	39.48617	39.04622	38.61311
48	41.59882	41.11986	40.64856	40.18478	39.72839	39.27924
49	42.34475	41.84785	41.35905	40.87820	40.40515	39.93975
50	43.08623	42.57113	42.06459	41.56645	41.07653	40.59470

- (i) Write down the present value interest factor from the table associated with Jackson's loan. 1

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- (ii) Calculate the interest that Jackson will pay over the term of his loan. 2

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- (b) The maximum speed (km/h) of a ski lift going up an incline to a plateau, is inversely proportional to the square of the total weight (kg) of the skiers in the lift.

A ski lift with a total weight of 348 kg has a maximum speed of 35 km/h.

What would be the total weight (to the nearest kilogram) on the lift if it has a maximum speed of 25 km/h? 3

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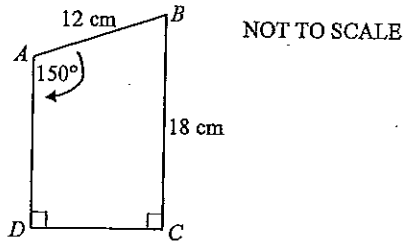
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Question 30 continues on the next page

Question 30 (continued)

Marks

- (c) The diagram shows a trapezium  $ABCD$  with  $AB = 12$  cm,  $BC = 18$  cm and angle  $BAD = 150^\circ$ .



Calculate the area of the trapezium. (Give your answer correct to one decimal place). 3

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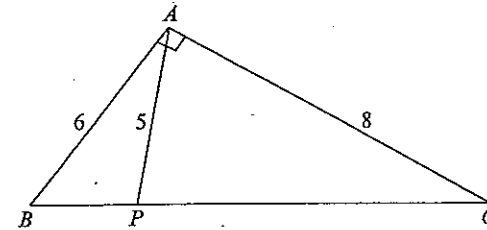
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Question 30 continues on the next page

Question 30 (continued)

Marks

- (d) In triangle  $ABC$ , angle  $BAC = 90^\circ$ ,  $AB = 6$ ,  $AC = 8$  and  $AP = 5$ .



- (i) Write down the value of  $\sin$  angle  $ABC$ . 1

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- (ii) Show that  $\sin$  angle  $APB = \frac{24}{25}$ . 3

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- (iii) What is the size (to the nearest degree) of angle  $PAC$ ? 2

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End of paper

**NSW INDEPENDENT TRIAL EXAMS – 2015  
GENERAL MATHEMATICS (YR12 TRIAL EXAM)  
MARKING GUIDELINES**

**Section I**

Question	Answer	Assessed Outcome	Band
1.	B	FSCo2, MGP8	2
2.	D	DS2/DS3, MGP2	2
3.	C	MM1, MGP3	3
4.	D	AM2, MGP3	3
5.	D	AM1, MGP2	3
6.	C	DS2, MGP7	3
7.	C	AM2/AM4, MGP3	4
8.	B	FSRe3, MG2H-5	3
9.	A	PB2/DS4, MG2H-2	3
10.	A	AM1, DS4, MG2H-1	4
11.	B	FSHe3, MG2H-2	4
12.	C	DS5, MG2H-7	4
13.	D	FSDr3, MGP8	4
14.	C	MM4, MG2H-5	4
15.	D	AM4, MG2H-3/6	4
16.	D	DS2, MGP7	4
17.	A	PB1, MGP8	4
18.	B	DS3, DS4, MG2H-3	4
19.	B	MM5, MG2H-4	5
20.	B	FSDr2, MGP6/8	5
21.	D	FSHe2, MG2H-2	5
22.	A	FSHe1, MG2H-5/7	5
23.	A	AM3, MG2H-9	6
24.	A	PB2, MG2H-8	6
25.	C	MM2, MGP4	6

**Section II  
Question 26**

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	$\frac{1}{2}$ of 50 cm = 25 cm	1	MM2, MGP-5	2
(ii)	$V = AH$ $= (0.5 \times \pi \times r^2) \times H$ $= (0.5 \times \pi \times 0.25^2) \times 1.2 \text{ m}^2$ $= 0.12 \text{ m}^3$	1 1	MM2, MGP-4	3
(iii)	Volume of packaging = $(0.4 \times 1.1 \times 1.2) - 0.12 \text{ m}^2$ $= 0.41 \text{ m}^3$	1 1	MM4, MG2H-5	3
(b)(i)	$S = (2 \times \pi \times 5^2) + (2 \times \pi \times 5 \times 20)$ $= 157.08 + 628.32$ $= 785.40 \text{ cm}^2$	1 1	MM4, MG2H-5	3
(ii)	Difference will be the area of 1 circular surface $= \pi \times 5^2$ $= 78.54 \text{ cm}^2$	1	MM4, MG2H-5	3
(iii)	Loss in surface area = area of 2 circular surfaces $= 2 \times 78.54$ $= 157.08 \text{ cm}^2$ Percentage loss = $\frac{157.08}{785.40} \times 100$ $= 20\%$	1 1	MM4, MGP4	4
(c)(i)	$A = 0.5 \times 35 \times 60 \times \sin 40^\circ$ $= 675 \text{ m}^2$	1 1	MM5, MG2H-4	3
(ii)	$AB^2 = 60^2 + 35^2 - (2 \times 60 \times 35 \times \cos 40^\circ)$ $= 1607.61$ $AB = 40 \text{ m}$	1 1 1	MM5, MG2H-5	4



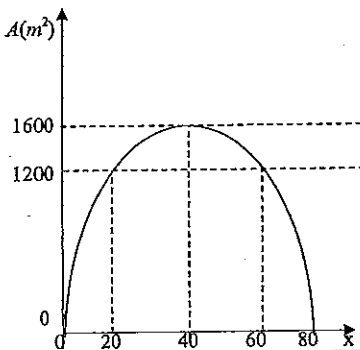
Question 27

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)		2	PB2, MG2H-8	4
(ii)	$P(B,W) \text{ or } P(W,B)$ $= \frac{5}{8} \times \frac{1}{2} + \frac{3}{8} \times \frac{3}{4}$ $= \frac{5}{16} + \frac{9}{32}$ $= \frac{19}{32}$	1 1 1	PB2, MG2H-2	4
(iii)	$1 - P(\text{no blue discs})$ $= 1 - (\frac{3}{8} \times \frac{1}{4})$ $= \frac{29}{32}$	1 1	PB2, MG2H-2	4
(b)(i)	$(0^\circ, 30^\circ W)$	1	MM6, MG2H-4	2
(ii)	$L = \frac{\theta}{360} \times 2 \times \pi \times R$ $5000 = \frac{\theta}{360} \times 2 \times \pi \times 6400$ $= \theta \times 111.7$ $\theta = 5000 \div 111.7$ $= 45^\circ \text{ (to the nearest degree)}$	1 1 1	MM6, MG2H-5	5
(iii)	$(0^\circ, 15^\circ E)$	1	MM6, MG2H-4	3
(iv)	The time difference between Y and A is $45 \times 4$ mins = 3 h When the plane takes off at Y, the local time at A is 12:15pm Flight time = $5000 \div 625 = 8$ hours The plane lands in A at 12:15pm + 8 hours = 8:15pm (local time)	1 1 1	MM6, M	4

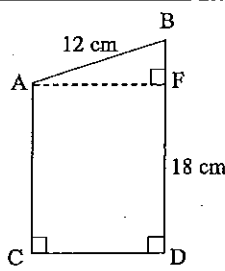
Question 28

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	$Z = \frac{x - \bar{x}}{\frac{s}{\sqrt{n}}}$ $= \frac{5.65 - 6.25}{\frac{0.3}{\sqrt{1500}}}$ $= -2$	1	DS5, MG2H-7	4
(ii)	The required length is $1.25 \times 0.3$ cm above the mean i.e. $6.25 + 1.25 \times 0.3$ $= 6.625$ cm	1	DS5, MG2H-7	5
(iii)	5.65 cm has a Z-score of -2 7.15 cm has a Z-score of 3 95% + 2.35% (i.e. 97.35%) of the rods have lengths between these scores Hence 2.65% of the rods would be unsuitable i.e. $0.0265 \times 1500$ $= 40$ (approx.)	1 1 1	DS5, MG2H7/10	5
(b)(i)	There were 20 000 more silver medals manufactured than gold medals.	1	AM4, MG2H-10	4
(ii)	$S = -G + 35\,000$ (1 mark for negative gradient, 1 mark for 35 000)	2	AM4, MGP3	4
(iii)	The intersection of the two graphs indicates the number of each type of medal manufactured.	1	AM4, MG2H-10	4
(iv)	$S = G + 20\,000$ ..... (1) $S = -G + 35\,000$ ..... (2) P is where $G + 20\,000 = -G + 35\,000$ i.e. $2G = 15\,000$ $G = 7\,500$ There were 7500 gold medals manufactured (Note that there are other methods of solving these equations to give the same result.)	1 1 1	AM2/AM4, MGP2/ MG2H-10	5
(v)	$FV = PV(1+r)^n$ $725 = 550(1+r)^5$ $(1+r)^5 = 1.318$ $1+r = 1.0568$ $r = 0.0568$ $= 5.7\%$	1 1 1	FM4, MG2H-9	6

Question 29

Part	Answers	Marks	Outcome Assessed	Band
(a)(i)	$x = 50, y = 30$ or many others.	1	MM2, MGP4	3
(ii)	Perimeter of rectangle is $2x + 2y$ $2x + 2y = 160$ $x + y = 80$ $y = 80 - x$	1 1	AM1, MGP2	4
(iii)		1 for shape as parabolic 1 for correct vertical scale	AM5, MG2H-9	5
(iv)	The maximum area occurs when $x = 40$ So $y = 80 - 40 = 40$	1 1	AM5, MG2H-3	5
(v)	Since both the length and width have the same dimensions, the enclosure would have maximum area when a square is formed from the 160 metres of fencing	1	AM5, MG2H-10	5
(vi)	Since the enclosure is a square, each side will have length $\frac{L}{4}$ metres Hence, the area (maximum) will be $(\frac{L}{4})^2$ $= \frac{L^2}{16}$	1 1	AM1/AM5 MG2H-10	6
(b)(i)	$\frac{h}{16} = \frac{810}{40}$ $h = 16 \times \frac{810}{40}$ $= 324 \text{ m}$	1 1 1	MM3, MGP4	5
(ii)	The angle of depression = the angle of elevation of the top of the tower to the bottom of the flag $\text{Tan } \theta = \frac{324}{770}$ $= 0.42078$ $\theta = 22^\circ 49'$ $= 23^\circ$	1 1	MM3, MGP4	5

Question 30

Part	Answer	Marks	Outcome Assessed	Band
(a)(i)	From the table, $r = 7.8\% \text{ p.a.}$ $= 0.65\% \text{ per month}$ $= 0.0065$ The period $N = 48$ months Hence the interest factor is $41.11986$	1	FM5, MG2H-6/9	5
(ii)	Monthly repayment = $15\,000 + 41.11986$ $= \$364.79$ Total repayments = $\$364.79 \times 48$ $= \$17\,509.79$ Interest = $\$17\,509.79 - \$15\,000$ $= \$2\,509.79$	1 1	FM5, MG2H-6	6
(b)	Let $S$ (Speed) = $\frac{k}{w^2}$ ( $w$ is the total weight) $35 = \frac{k}{348^2}$  $k = 4238640$  Hence $S = \frac{4238640}{w^2}$  Now if $S = 25$ then $25 = \frac{4238640}{w^2}$ $w^2 = 4238640 \div 25$ $w = 411.75 \text{ kg} = 412 \text{ kg}$	1 1 1	AM5, MG2H-3	6
(c)	 <p>Insert AF. <math>\angle BAF = 60^\circ</math>. <math>\cos 60^\circ = \frac{AF}{AB} = \frac{AF}{12}</math> Hence <math>AF = 6</math> Using Pythagoras Theorem, <math>BF^2 = 12^2 - 6^2</math> <math>BF = 10.4</math> Area of trapezium = <math>\frac{1}{2} \times AF \times (AC + BD)</math> <math>= \frac{1}{2} \times 6 \times ((18 - 10.4) + 18)</math> <math>= 76.8 \text{ cm}^2</math></p>	1 1 1	MM2/MM3, MGP-4	6

Question 30 continues on the next page

(d)(i)	In $\triangle ABC$ , $BC = 10$ and $\sin \angle ABC = \frac{8}{10} = \frac{4}{5}$	1	MM3, MGP4	4
(ii)	Using the Sine rule in $\triangle ABP$ $\frac{\sin \angle APB}{6} = \frac{\sin \angle ABP}{5}$ $\sin \angle APB = \frac{6 \times \sin \angle ABP}{5}$ $= \frac{6 \times \frac{4}{5}}{5}$ $= \frac{24}{5} \div 5$ $= \frac{24}{5} \times \frac{1}{5}$ $= \frac{24}{25}$	1  1  1	MM5, MG2H-4	6
(iii)	$\sin \angle ABC = \frac{4}{5}$ $\angle ABC = 53^\circ$ $\sin \angle APB = \frac{24}{25}$ $\angle APB = 74^\circ$ Hence $\angle BAP = 53^\circ$ So $\angle PAC = 90^\circ - 53^\circ$ $= 37^\circ$	1  1	MM5, MG2H-4/5	6