

Student Name: _____

Practice Paper 4

YEAR 12

YEARLY EXAMINATION

Mathematics General 2

Section I

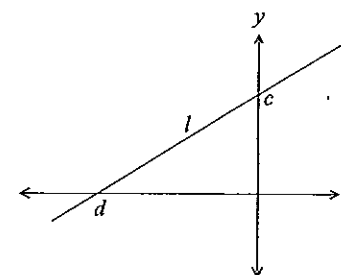
25 marks

Attempt Questions 1 - 25

Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1-25

- Simplify $6x^2 + 2x + 4x^2$
 - $12x^2$
 - $12x^4$
 - $10x^2 + 2x$
 - $10x^4 + 2x$
- Which of the following represents 0.5 terabytes using standard notation?
 - 0.55×10^{11} B
 - 0.55×10^{12} B
 - 5.5×10^{11} B
 - 5.5×10^{12} B
- The line l has intercepts c and d , where c and d are integers.

What is the gradient of line l ?

- $-\frac{c}{d}$
- $-\frac{d}{c}$
- $\frac{c}{d}$
- $\frac{d}{c}$

General Instructions

- Reading time - 5 minutes
- Working time - 2.5 hours
- Write using black or blue pen
- Board-approved calculators may be used
- A formula and data sheet is provided at the back of this paper
- In Questions 26-30, show relevant mathematical reasoning and/or calculations

Total marks - 100

Section I

25 marks

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

Section II

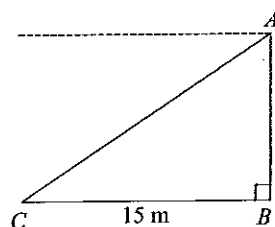
75 marks

- Attempt Questions 26-30
- Allow about 1 hour 55 minutes for this section

- 4 Isaac buys 5 tickets in a raffle where 230 tickets were sold. He wins first prize. What is the probability that he also wins second prize?

- (A) $\frac{1}{230}$
 (B) $\frac{1}{46}$
 (C) $\frac{2}{115}$
 (D) $\frac{4}{229}$

- 5 The angle of depression from A to C is 40° . The distance from B to C is 15 metres.

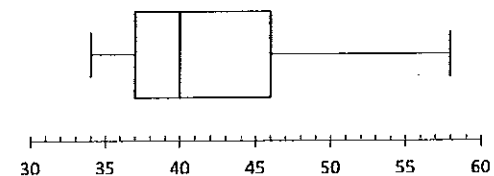


Not to scale

How high above B is A , to the nearest metre?

- (A) 10 m
 (B) 11 m
 (C) 13 m
 (D) 18 m
- 6 Jasmine purchased a used car for \$7 500 and depreciated it by \$700 each year. What is its depreciated value after three years?
- (A) \$4 700
 (B) \$5 400
 (C) \$6 100
 (D) \$6 800
- 7 Which of the following is a false statement?
- (A) Population mean is denoted by \bar{x}
 (B) Population is the entire data set.
 (C) Sample is part of a population.
 (D) Sample statistics are a measurable characteristic of a sample.

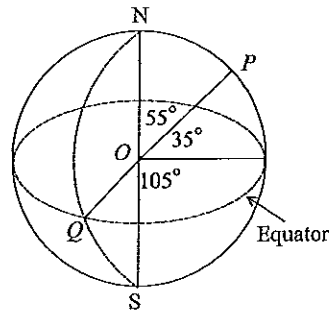
- 8 The box-and-whisker plot shows the assessment results of 160 students.



Which of the following statements is *false*?

- (A) Data is negatively skewed.
 (B) Median score is 40.
 (C) 120 students achieved a score greater than the lower quartile.
 (D) 40 students achieved a score greater than 46.
- 9 Adelaide is located at $(35^\circ\text{N}, 139^\circ\text{E})$ and Yokohama is located at $(35^\circ\text{S}, 139^\circ\text{E})$. What is the distance between Adelaide and Yokohama to the nearest kilometre? (Assume the radius of the earth is 6400 km).
- (A) 559
 (B) 3910
 (C) 7819
 (D) 15 526
- 10 There are four people sharing a house. Each person has a shower each day and uses 120 L of water per shower. Water costs \$2.34 per kilolitre (kL). It is decided to install a water-efficient showerhead that uses 35% less water. How much could be saved on water costs each year?
- (A) \$41
 (B) \$143
 (C) \$266
 (D) \$410
- 11 What is the slope of the least-squares regression line given $r = 0.561$, $s_x = 1.987$ and $s_y = 4.579$?
- (A) 0.24
 (B) 1.29
 (C) 7.13
 (D) 16.21

- 12 In the diagram, O represents the centre of the earth, and Q lies on both the Equator and the Greenwich Meridian.



Not to scale

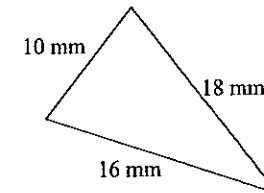
What is the latitude and longitude of point P ?

- (A) $35^\circ\text{N } 105^\circ\text{E}$
 (B) $35^\circ\text{N } 105^\circ\text{W}$
 (C) $55^\circ\text{N } 105^\circ\text{E}$
 (D) $55^\circ\text{N } 105^\circ\text{W}$
- 13 A pair of players is to be selected from 7 people. How many different pairs of players can be selected?
 (A) 7
 (B) 14
 (C) 21
 (D) 42
- 14 A 120 watt ceiling fan is run for 24 hours each day. If electricity is charged at 24.8 c/kWh, what is the cost of running the ceiling fan for 30 days, to the nearest cent?
 (A) \$15.68
 (B) \$21.43
 (C) \$86.40
 (D) \$2142.73
- 15 A computer was purchased for \$2400 on 11 June 2013 using a credit card. Simple interest is charged at a rate of 18.75% per annum for purchases using a credit card. No other purchases were made and there was no interest-free period. The period for which interest was charged included the date of purchase and the date of payment. What amount was required to pay the account in full on 19 July 2013?
 (A) \$2446.85
 (B) \$2447.20
 (C) \$2448.08
 (D) \$2449.32

- 16 Lachlan earns \$81 500 in a year. His allowable deductions total \$4 000. Using the table below, which of the following expressions represents his total tax payable?

Taxable income	Tax payable
0 - \$18 200	Nil
\$18 201 - \$37 000	Nil + 19 cents for each \$1 over \$18 200
\$37 001 - \$80 000	\$3572 + 32.5 cents for each \$1 over \$37 000
\$80 001 - \$180 000	\$17 550 + 37 cents for each \$1 over \$80 000
\$180 001 and over	\$54 550 + 45 cents for each \$1 over \$180 000

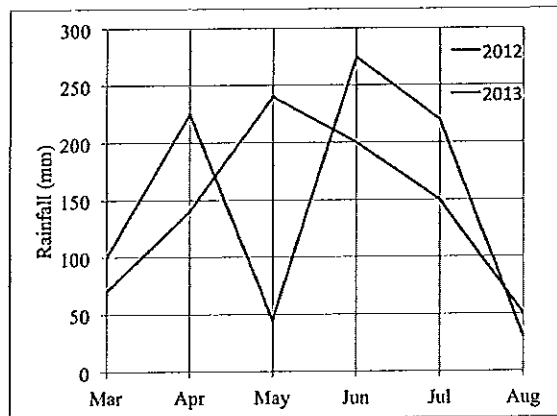
- (A) $\$3572 + \$40\,500 \times 0.325$
 (B) $\$3572 + \$44\,500 \times 0.325$
 (C) $\$17\,550 + \$1\,500 \times 0.37$
 (D) $\$17\,550 + \$5\,500 \times 0.37$
- 17 What is the best description between living standards and life expectancy?
 (A) Constant correlation
 (B) Negative correlation.
 (C) Positive correlation.
 (D) Zero correlation.
- 18 What is the size of the smallest angle (θ) in the triangle below?



Not to scale

- (A) $\cos \theta = \frac{16^2 + 18^2 - 10^2}{2 \times 10 \times 16}$
 (B) $\cos \theta = \frac{10^2 + 18^2 - 16^2}{2 \times 10 \times 18}$
 (C) $\cos \theta = \frac{10^2 + 18^2 - 16^2}{2 \times 10 \times 16}$
 (D) $\cos \theta = \frac{16^2 + 18^2 - 10^2}{2 \times 16 \times 18}$

19 The monthly rainfall for Madison City is shown below.



In which month was there the smallest difference in rainfall between 2012 and 2013?

- (A) March
- (B) May
- (C) June
- (D) August

20 A double radar chart is constructed with 12 sectors. What is the size of the angle in each sector?

- (A) 10
- (B) 18
- (C) 30
- (D) 36

21 Oscar buys a mobile phone for \$800. He pays it off monthly over 3 years at an interest rate of 9.5% p.a. How much per month will he pay?

- (A) \$29
- (B) \$86
- (C) \$228
- (D) \$343

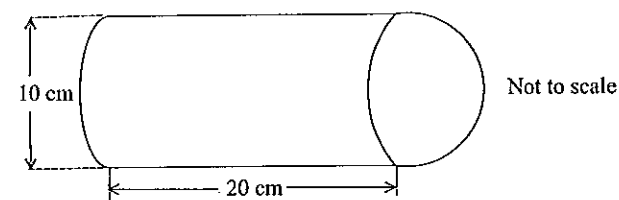
22 A factory produces bags of cashews. The weights of the bags are normally distributed, with a mean of 900 g and a standard deviation of 50 g. What is the best approximation for the percentage of bags that weigh more than 1000 g?

- (A) 0%
- (B) 2.5%
- (C) 5%
- (D) 16%

23 Which of the following correctly expresses c as the subject of $A = bc^2 + d$?

- (A) $c = \pm \sqrt{\frac{A-d}{b}}$
- (B) $c = \pm \frac{\sqrt{A-d}}{b}$
- (C) $c = \pm \sqrt{\frac{A}{b} - d}$
- (D) $c = \pm \sqrt{\frac{A}{b} - d}$

24 The solid shown is made of a cylinder with a hemisphere (half a sphere) on the right.



What is the total surface area of the solid, to the nearest square centimetre?

- (A) 707 cm²
- (B) 785 cm²
- (C) 864 cm²
- (D) 942 cm²

25 The speed (v), in km/h, of a ski lift is inversely proportional to the weight (w kg) it carries. A ski lift carrying a weight of 320 kg can travel at 16 km/h. What is the speed of the ski lift if weight decreases to 250 kg?

- (A) $\frac{16 \times 250}{320}$
- (B) $\frac{16 \times 320}{250}$
- (C) $\frac{250 \times 320}{16}$
- (D) $\frac{320}{16 \times 250}$

Section II

75 marks

Attempt Questions 26–30

Allow about 1 hour and 55 minutes for this section

Answer the questions in the spaces provided.

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

Question 26 (15 marks)

Marks

- (a) Sophie borrowed \$192 000 at an interest rate of 5.25% per annum compounded monthly. The repayments have been set at \$900 per month.

Months (n)	Principal (P)	Interest (I)	Repayment	Balance
1	\$192 000	\$840	\$900	
2			\$900	

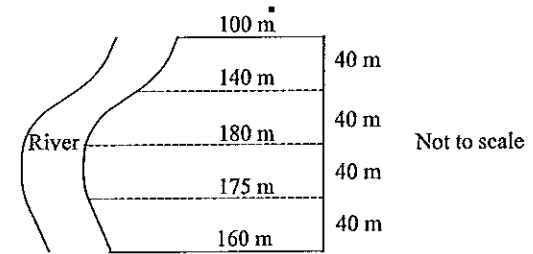
- (i) Explain why the interest charged for the first month is \$840. 1

- (ii) How much is owed at the end of the first month? 1

- (iii) What is the interest charged for the second month? Answer to the nearest cent. 2

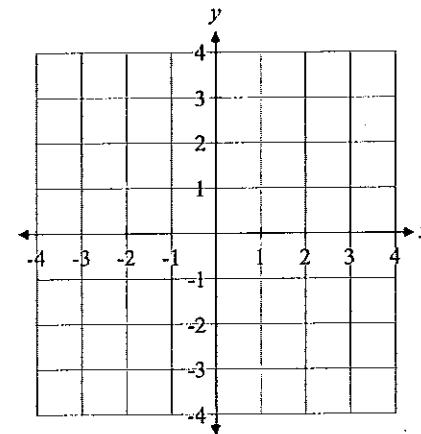
- (b) Simplify $(6xy^2)^3 \times (2x^4y^6)^2$ 2

- (c) A riverside campsite is shown below

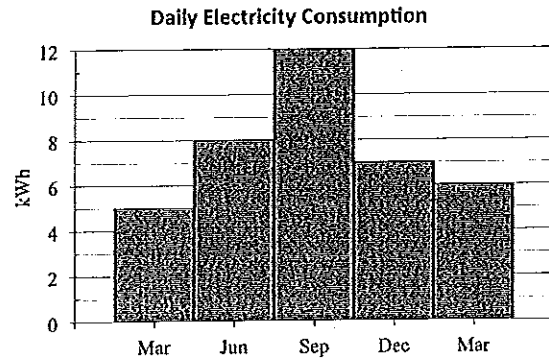


Use two applications of Simpson's rule to approximate the area of the campsite. Answer correct to the nearest square metre. 2

- (d) Draw the graph of $y = -2x - 3$ and find the gradient and y -intercept. 2



(e) The graph is part of an electricity account issued to a customer.



(i) How many times per year is the electricity meter read? 1

(ii) In which quarter was the usage of the electricity least? 1

(iii) How much electricity did this household use per day in the June quarter? 1

(f) A credit card has a daily simple interest rate of 0.059% per day (no interest free period). Find the interest charged on \$2210 for 14 days. Answer correct to the nearest cent. 2

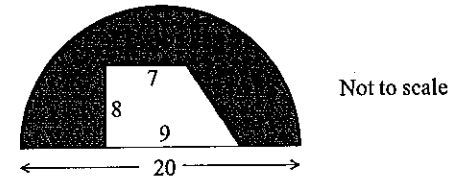
Question 27 (15 marks)

Marks

(a) Alex is planning a trip to Toronto (44°N 79°W) from Sydney (34°S 151°E).
 (i) What is the difference in time between Toronto and Sydney? 1

(ii) Alex plans to leave Sydney at 6 am on a Sunday. What is the time in Toronto when he leaves Sydney? 1

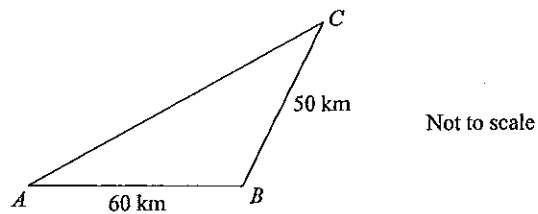
(b) The diagram shows a semicircle, from which a trapezium has been cut. All measurements are in centimetres. 3



What is the area of the remaining shape, to the nearest square centimetre?

(c) Clark's rule $\left(\text{Dosage} = \frac{\text{Weight (kg)} \times \text{Adult dose}}{70} \right)$ is used to calculate dosages of medicine for children. What is the medication dose for Tyler, if he weighs 28 kg and the adult dose is 15 mL? 2

- (d) The diagram shows three towns. Town A is due west of town B and the bearing of town C from town B is 025° .



- (i) What is the size of $\angle ABC$? 1
- _____
- _____
- (ii) Find the distance (to nearest kilometre) from town A to town C . 2
- _____
- _____
- _____
- (iii) What is the bearing of town C from town A ? 2
- _____
- _____
- _____
- (e) In a game two unbiased coins are tossed. A player outlays \$30 and if both coins show tails the player is paid \$48, if both coins show heads the player is paid \$60.
- (i) What is the probability of throwing two tails? 1
- _____
- _____
- (ii) What is the expected return from \$300 for this game? 2
- _____
- _____

Question 28 (15 marks)

Marks

- (a) Solve the following equations:

(i) $9x - 2 = -11$ 1

(ii) $2(a + 5) = 28$ 1

(iii) $\frac{4y}{3} + 3y - 5 = 0$ 1

- (b) A rain gauge registered 60 mm of rain during a storm. The rain fell on a shed with a rectangular roof that measures 25 metres by 10 metres.

(i) How many litres of water fell on the shed? Answer to the nearest litre 2

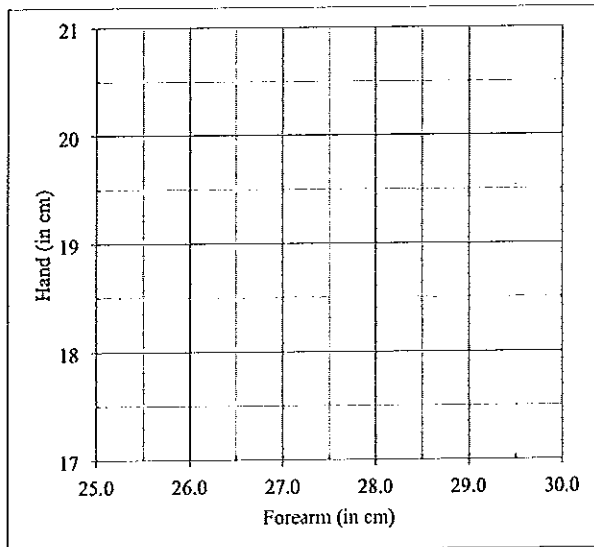
- (ii) The water that fell on the shed was collected in an empty cylindrical tank with a diameter of 6 metres. What depth of water will be in the tank? Answer correct to two decimal places. 2

(c) The table below shows forearm length and hand length.

Forearm (in cm)	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0	29.5
Hand (in cm)	17.3	17.6	18.2	18.4	19	19.4	19.8	20.1	20.4	20.6

(i) Draw a scatterplot using the above table.

1



(ii) Draw a line of best fit on the scatterplot.

1

(iii) Describe the correlation between the forearm length and hand length.

1

(d) Two cities lie on the same meridian of longitude and are 4356 km apart. One city is located on the parallel of latitude of 47°N . What is the latitude of the second city if it is south of the first city?

2

(e) Nicholas borrows \$204 000 over 7 years at an interest rate of 8.9% p.a. reducible. He pays \$1776 per fortnight.

(i) How much will Nicholas pay back altogether?

1

(ii) What is the interest paid for this loan?

1

(iii) What is the equivalent flat interest rate charged per annum on this loan? Answer correct to 1 decimal place.

1

Question 29 (15 marks)

Marks

- (a) The table shows the present value interest factors for some monthly interest rates and loan periods in months. 2

Present value of \$1				
Period	0.0060	0.0065	0.0070	0.0075
46	40.09350	39.64965	39.21263	38.78231
47	40.84841	40.38714	39.93310	39.48617
48	41.59882	41.11986	40.64856	40.18478
49	42.34475	41.84785	41.35905	40.87820

Hayley borrows \$16 000 for a car. She arranges to repay the loan with monthly repayments over 4 years. She is charged 8.4% per annum interest. Using the table, calculate the amount of interest Hayley will pay over the term of the loan

- (b) The capture-recapture technique was used to estimate the population of penguins in 2013. 2

- 50 penguins were caught, tagged and released.
- Later, 110 penguins were caught at random.
- 20 of these 110 penguins had been tagged.

The estimated population of the penguins in 2013 was 13% less than the estimated population for 2012.

What was the estimated population for 2012?

- (c) (i) In a class test Charlie has a z-score of 2. What does that mean? 1

- (ii) The mean for the test is 64% and the standard deviation is 12.5. Hannah obtains a z-score of -2. What is her mark? 1

- (iii) Jacob has a mark of 51.5%. What is his z-score? 1

- (iv) Lucy said she had a z-score of 3 but Hannah is unconvinced. Why? 1

- (d) On a biased coin, the probability of throwing a head is 60%. The coin is tossed twice. What is the probability of at least one head being tossed? 2

- (e) Jack has a mobile phone contract that charges a monthly access fee of \$79, free calls \$250, flagfall \$0.35 and call rate of \$0.45 per 30 second. What is the monthly charge if Jack made 300 calls whose duration was less than 30 seconds? 1

(f) Solve the following pair of simultaneous equations. 2

$$2x - 3y = -1$$

$$x + 2y = 10$$

(g) Life expectancy and gym memberships have both risen strongly in the last decade. Is this strong relationship between the two correlational or causal? 2

Question 30 (15 marks)

Marks

(a) Ethan surveyed his friends to check the number of text messages received on a given day. The number of messages found were 18, 3, 17, 24, 37, 1, 23, 16, 19, 8, 5, 11, 10, 17, 4, 19, 30, 18, 30, 25, 6, 28, 24, 9, 10, 22 and 12.

(i) Complete the grouped frequency table. 1

Class	Class Centre	Frequency	Cumulative Frequency
0-9			
10-19			
20-29			
30-39			

(ii) How many friends were surveyed? 1

(iii) What is the modal class? 1

(iv) What is the mean number of text messages?
Answer correct to one decimal place. 1

(v) Find the population standard deviation.
Answer correct to one decimal place. 1

(vi) What percentage of friends had less than 10 text messages received on a given day? Answer correct to the nearest percentage. 1

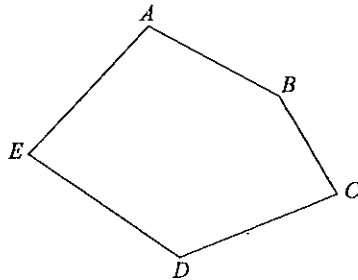
(b) Lucas's watering can is initially filled with 4 litres of water. However the watering can has a small hole in the base and is leaking at a rate of 0.2 litres per minute.

(i) Write a linear equation in the form $V = mt + b$ to describe this situation. 1

(ii) What volume of water remains after 150 seconds? 1

(iii) How long would it take for all the water to leak out? 1

(c) Harry is constructing a plane table radial survey of the field $ABCDE$. 2



Harry starts with the following steps.

1. Table and large sheet of paper are placed in the centre of the field.
2. A point P is marked on the paper roughly near the centre.

Describe how Harry would complete the survey.

(d) A tennis competition involves every player having a match against every other player. The number of matches is calculated using the formula:

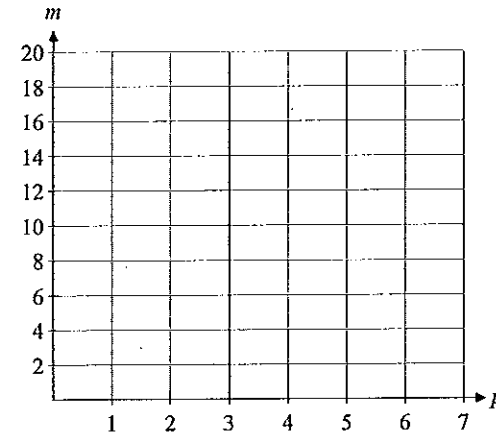
$$m = \frac{1}{2}(p^2 - p)$$

where m is the number of matches and p the number of players.

(i) Complete the table of values for the above formula. 1

m	1	2	3	4	5	6
p						

(ii) Plot the points from the table of values. Join the points. 1



(iii) Use the model to predict the number of matches for 7 players. 1

(iv) Explain why you would not use the model when p is less than one. 1

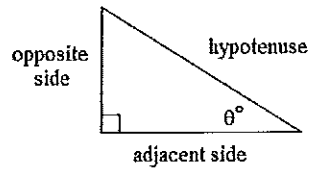
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FORMULAE AND DATA SHEET

Financial Mathematics	Data Analysis
<p>Simple interest</p> $I = Prn$ <p><i>P</i> is initial amount <i>r</i> is interest rate per period, expressed as a decimal <i>n</i> is number of periods</p>	<p>Mean of a sample</p> $\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$ <p>z-score</p> <p>For any score <i>x</i>,</p> $z = \frac{x - \bar{x}}{s}$ <p><i>x</i> is mean <i>s</i> is standard deviation</p>
<p>Compound interest</p> $A = P(1+r)^n$ <p><i>A</i> is final amount <i>P</i> is initial amount <i>r</i> is interest rate per period, expressed as a decimal <i>n</i> is number of compounding periods</p>	<p>Outlier(s)</p> <p>score(s) less than $Q_L - 1.5 \times IQR$ or score(s) more than $Q_U + 1.5 \times IQR$</p> <p><i>Q_L</i> is lower quartile <i>Q_U</i> is upper quartile <i>IQR</i> is interquartile range</p>
<p>Present value and future value</p> $PV = \frac{FV}{(1+r)^n}, FV = PV(1+r)^n$ <p><i>r</i> is interest rate per period, as expressed as a decimal <i>n</i> is number of compounding periods</p>	<p>Least-squares line of best fit</p> $y = \text{gradient} \times x + y\text{-intercept}$ $\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$ $y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$ <p><i>r</i> is correlation coefficient \bar{x} is mean of <i>x</i> score \bar{y} is mean of <i>y</i> scores</p>
<p>Straight-line method of depreciation</p> $S = V_0 - Dn$ <p><i>S</i> is salvage value of asset after <i>n</i> periods <i>V₀</i> is initial value of asset <i>D</i> is amount of depreciation per period <i>n</i> is number of periods</p>	<p>Normal distribution</p> <ul style="list-style-type: none"> • approximately 68% of scores have z-scores between -1 and 1 • approximately 95% of scores have z-scores between -2 and 2 • approximately 99.7% of scores have z-scores between -3 and 3
<p>Declining-balance method of depreciation</p> $S = V_0(1-r)^n$ <p><i>S</i> is salvage value of asset after <i>n</i> periods <i>V₀</i> is initial value of asset <i>r</i> is depreciation rate per period, expressed as a decimal <i>n</i> is number of periods</p>	

Spherical Geometry	Surface Area
<p>Circumference of a circle</p> $C = 2\pi r \text{ or } C = \pi d$ <p><i>r</i> is radius <i>d</i> is diameter</p> <p>Arc length of a circle</p> $l = \frac{\theta}{360} 2\pi r$ <p><i>r</i> is radius θ is number of degrees in central angle</p>	<p>Sphere</p> $A = 4\pi r^2$ <p><i>r</i> is radius</p> <p>Closed cylinder</p> $A = 2\pi r^2 + 2\pi rh$ <p><i>r</i> is radius <i>h</i> is perpendicular height</p>
<p>Radius of Earth</p> <p>(taken as) 6400 km</p> <p>Time differences</p> <p>For calculation of time differences using longitude: 15° = 1 hour time difference</p>	<p>Volume</p> <p>Prism or cylinder</p> $V = Ah$ <p><i>r</i> is radius <i>h</i> is perpendicular height</p> <p>Pyramid or cone</p> $V = \frac{1}{3} Ah$ <p><i>A</i> is area of the base <i>h</i> is perpendicular height</p> <p>Volume and capacity</p> <p>unit conversion: 1 m³ = 1000 L</p>
<p>Area</p> <p>Circle</p> $A = \pi r^2$ <p><i>r</i> is radius</p> <p>Sector</p> $A = \frac{\theta}{360} \pi r^2$ <p><i>r</i> is radius θ is number of degrees in central angle</p> <p>Annulus</p> $A = \pi(R^2 - r^2)$ <p><i>R</i> is radius of outer circle <i>r</i> is radius of inner circle</p> <p>Trapezium</p> $A = \frac{h}{2}(a+b)$ <p><i>h</i> is perpendicular height <i>a</i> and <i>b</i> are the lengths of the parallel sides</p> <p>Area of land and catchment areas</p> <p>unit conversion: 1 ha = 10 000 m²</p>	<p>Approximation Using Simpson's Rule</p> <p>Area</p> $A \approx \frac{h}{3}(d_f + 4d_m + d_l)$ <p><i>h</i> distance between successive measurements <i>d_f</i> is first measurement <i>d_m</i> is middle measurement <i>d_l</i> is last measurement</p> <p>Volume</p> $V \approx \frac{h}{3}(A_L + 4A_m + A_R)$ <p><i>h</i> distance between successive measurements <i>A_L</i> is area of left end <i>A_M</i> is area of middle <i>A_R</i> is area of right end</p>

Trigonometric Ratios



$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine rule

In $\triangle ABC$

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

Cosine rule

In $\triangle ABC$

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

or

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

Units of Memory and File Size

$$1 \text{ byte} = 8 \text{ bits}$$

$$1 \text{ kilobyte} = 2^{10} \text{ bytes} = 1024 \text{ bytes}$$

$$1 \text{ megabyte} = 2^{20} \text{ bytes} = 1024 \text{ kilobytes}$$

$$1 \text{ gigabyte} = 2^{30} \text{ bytes} = 1024 \text{ megabytes}$$

$$1 \text{ terabyte} = 2^{40} \text{ bytes} = 1024 \text{ gigabytes}$$

Blood Alcohol Content Estimates

$$BAC_{\text{Male}} = \frac{(10N - 7.5H)}{6.8M} \text{ or}$$

$$BAC_{\text{Female}} = \frac{(10N - 7.5H)}{5.5M}$$

N is number of standard drinks consumed

H is number of hours of drinking

M is person's mass in kilograms

Distance, Speed and Time

$$D = ST, S = \frac{D}{T}, T = \frac{D}{S}$$

$$\text{average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$\text{stopping distance} = \left\{ \begin{array}{l} \text{reaction-time} \\ \text{distance} \end{array} \right\} + \left\{ \begin{array}{l} \text{braking} \\ \text{distance} \end{array} \right\}$$

Probability of an Event

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

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

Straight Lines

Gradient

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

Gradient-Intercept form

$$y = mx + b$$

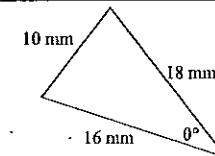
m is gradient

b is y-intercept

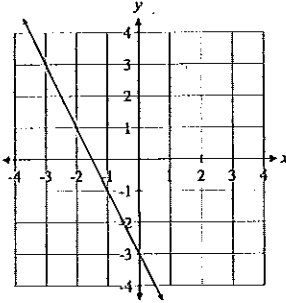
ACE Examination Practice Paper 4
 HSC Mathematics General 2 Yearly Examination
 Worked solutions and marking guidelines

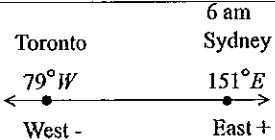
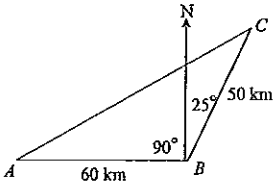
Section 1		
	Solution	Criteria
1	$6x^2 + 2x + 4x^2 = 10x^2 + 2x$	1 Mark: C
2	$0.5 \text{ TB} = 0.5 \times 2^{40} \text{ B}$ $\approx 5.5 \times 10^{11}$	1 Mark: C
3	Gradient = $\frac{\text{Rise}}{\text{Run}}$ $= \frac{c}{d}$	1 Mark: C
4	$P(E) = \frac{4}{229}$	1 Mark: D
5	$\tan 40^\circ = \frac{AB}{15}$ $AB = 15 \tan 40 = 12.58649447... \approx 13 \text{ m}$	1 Mark: C
6	$S = V_0 - Dn$ $= 7500 - 700 \times 3$ $= \$5400$	1 Mark: B
7	Population mean is denoted by μ not \bar{x} (sample mean)	1 Mark: A
8	(A) Data is more on the left side. Data is positively skewed* (B) Median is 40 (middle line of the box)✓ (C) 75% of 160 = $0.75 \times 160 = 120$ ✓ (D) 25% of 160 = $0.25 \times 160 = 40$ ✓	1 Mark: A
9	Latitude difference = $35 + 35 = 70$ $l = \frac{\theta}{360} \times 2\pi r$ $= \frac{70}{360} \times 2 \times \pi \times 6400$ $= 7819.075049... \approx 7819 \text{ km}$	1 Mark: C
10	Water costs = $4 \times 365 \times 0.120 \times \$2.34 = \$409.968$ Savings = $0.35 \times \$409.968$ $= \$143.4888 \approx \143	1 Mark: B

11	$m = r \frac{s_y}{s_x}$ $= 0.561 \times \frac{4.579}{1.987}$ $= 1.29$	1 Mark: B
12	$35^\circ \text{N } 105^\circ \text{E}$	1 Mark: A
13	Number of selections = $\frac{7 \times 6}{2}$ $= 21$	1 Mark: C
14	Electricity = $0.120 \times 24 \times 30$ $= 86.4 \text{ kWh}$ Cost = $\$0.248 \times 86.4$ $= \$21.4272$ $\approx \$21.43$	1 Mark: B
15	Number of days from 11 Jun to 19 Jul is 39. $I = Prn$ $= \$2400 \times \frac{0.1875}{365} \times 39$ $= 48.08219178...$ $= \$48.08$ Amount due is \$2448.08	1 Mark: C
16	Tax payable = $\$81\,500 - \$4\,000 = \$77\,500$ Taxable income between \$37 001 and \$80 000 (3 rd line) $\$3572 + \$40\,500 \times 0.325$	1 Mark: A
17	A rise in the living standards results in a rise in life expectancy. Positive correlation.	1 Mark: C
18	Smallest angle is opposite smallest side $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ $\cos \theta = \frac{(16^2 + 18^2 - 10^2)}{(2 \times 16 \times 18)}$	1 Mark: D
19	The smallest difference is August ($50 - 30 = 20 \text{ mm}$)	1 Mark: D
20	Sector angle = $360 \div 12$ $= 30^\circ$	1 Mark: C



21	$I = Prn$ $= \$800 \times 0.095 \times 3 = \228 $\text{Monthly repayment} = \frac{\$800 + \$228}{3 \times 12}$ $= 28.5555\dots$ $\approx \$29$	1 Mark: A
22	$z = \frac{x - \bar{x}}{s}$ $= \frac{1000 - 900}{50}$ $= 2$ <p>95% of scores have a z-score between -2 and 2 Therefore 2.5% have a z-score greater than 2.</p>	1 Mark: B
23	$A = bc^2 + d$ $bc^2 = A - d$ $c^2 = \frac{A - d}{b}$ $c = \pm \sqrt{\frac{A - d}{b}}$	1 Mark: A
24	$A = \frac{1}{2} \times 4\pi r^2 + \pi r^2 + 2\pi rh$ $= 3\pi r^2 + 2\pi rh$ $= 3\pi \times 5^2 + 2\pi \times 5 \times 20$ $= 863.937979\dots$ $\approx 864 \text{ cm}^2$	1 Mark: C
25	$v = \frac{k}{w} \quad \text{Therefore } v = \frac{k}{w}$ $320 = \frac{k}{16} \quad = \frac{16 \times 320}{250}$ $k = 16 \times 320$	1 Mark: B

Section II		Criteria
	Solution	
26(a) (i)	$A = P(1+r)^n$ $= \$192000 \times \left(1 + \frac{0.0525}{12}\right)^1 = \$192\,840$ $I = A - P$ $= \$192840 - \$192000 = \$840$ <p>Interest charged is \$840</p>	1 Mark: Correct answer.
26(a) (ii)	$\text{Balance} = \$192000 + \$840 - \$900$ $= \$191\,940$ <p>Sophie owes \$191 940 at the end of 1st month</p>	1 Mark: Correct answer.
26(a) (iii)	$A = P(1+r)^n$ $= \$191940 \times \left(1 + \frac{0.0525}{12}\right)^1 = \$192\,779.74$ $I = A - P$ $= \$192779.74 - \$191940 = \$839.74$ <p>Interest charged is \$839.74</p>	2 Marks: Correct answer. 1 Mark: Finds the amount owing or shows some understanding.
26(b)	$(6xy^2)^3 \times (2x^4y^6)^2 = 216x^3y^6 \times 4x^8y^{12}$ $= 864x^{11}y^{18}$	2 Marks: Correct answer. 1 Mark: Applies one index law correctly.
26(c)	$A = \frac{h}{3}(d_f + 4d_m + d_l)$ $= \frac{40}{3}(160 + 4 \times 175 + 180) + \frac{40}{3}(180 + 4 \times 140 + 100)$ $= 25066.6666\dots \approx 25067 \text{ m}^2$	2 Marks: Correct answer. 1 Mark: Uses Simpsons with one correct value.
26(d)	$y = mx + b \quad \text{Gradient is } -2 \text{ and } y\text{-intercept is } -3$ $y = -2x - 3$ 	2 Marks: Correct answer. 1 Mark: Correct graph or finds the gradient and y-intercept.

26(e) (i)	Electricity meter is read 4 times a year.	1 Mark: Correct answer.
26(e) (ii)	March quarter was the least (5 kWh).	1 Mark: Correct answer.
26(e) (iii)	June quarter consumption is 8 kWh per day.	1 Mark: Correct answer.
26(f)	$I = Prn$ $= \$2210 \times 0.00059 \times 14$ $= \$18.2546$ $\approx \$18.25$ Interest owing is \$18.25.	2 Marks: Correct answer. 1 Mark: Uses the simple formula with at least one correct value.
27(a) (i)	Longitude difference = $79^\circ + 151^\circ = 230^\circ$ Time difference = 230×4 $= 920 \text{ min or } 15 \text{ h } 20 \text{ min}$	1 Mark: Correct answer.
27(a) (ii)	 <p>Toronto is west of Sydney. Subtract the time difference. Toronto = 6.00 am - 15 h 20 min $= 2.40 \text{ pm on Saturday}$</p>	1 Mark: Correct answer.
27(b)	Semicircle $A = \frac{1}{2}\pi r^2 = \frac{1}{2} \times \pi \times 10^2 = 157.079327 \dots \text{ cm}^2$ Trapezium $A = \frac{1}{2}(a+b)h = \frac{1}{2} \times (7+9) \times 8 = 64 \text{ cm}^2$ Shaded area = $157.079 \dots - 64$ $= 93.079$ $\approx 93 \text{ cm}^2$	3 Marks: Correct answer. 2 Marks: Makes significant progress. 1 Mark: Finds the area of the semicircle or the trapezium.
27(c)	Dosage = $\frac{\text{Weight (kg)} \times \text{Adult dose}}{70}$ $= \frac{28 \times 15}{70}$ $= 6 \text{ mL}$	2 Marks: Correct answer. 1 Mark: Substitutes one correct value into the formula.
27(d) (i)	$\angle ABC = 90^\circ + 25^\circ$ $= 115^\circ$ 	1 Mark: Correct answer.

27(d) (ii)	$b^2 = a^2 + c^2 - 2ac \cos B$ $AC^2 = 50^2 + 60^2 - 2 \times 50 \times 60 \times \cos 115^\circ$ $AC = 92.92851861 \dots$ $\approx 93 \text{ km}$ The distance from town A to town C is 93 km.	2 Marks: Correct answer. 1 Mark: Uses the cosine rule with at least one correct value.
27(d) (iii)	Use the sine rule to find $\angle BAC$ $\frac{\sin \angle BAC}{50} = \frac{\sin 115^\circ}{93}$ $\sin \angle BAC = \frac{50 \sin 115^\circ}{93}$ $\angle BAC = 29.1607955 \dots \approx 29^\circ$ Bearing = $90^\circ - 29^\circ = 61^\circ$ Bearing of town C from town A is 061° .	2 Marks: Correct answer. 1 Mark: Uses the sine rule with at least one correct value.
27(e) (i)	$P(TT) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$	1 Mark: Correct answer.
27(e) (ii)	Financial expectation $= \left(\frac{1}{4} \times \$48\right) + \left(\frac{1}{4} \times \$60\right) + \left(\frac{1}{2} \times -\$30\right) = \$12$ Expected return = $\$12 \times 10 = \120 (10 games for \$300)	2 Marks: Correct answer. 1 Mark: Calculates the financial expectation.
28(a) (i)	$9x - 2 = -11$ $9x = -9$ $x = -1$	1 Mark: Correct answer.
28(a) (ii)	$2(a+5) = 28$ $\frac{2(a+5)}{2} = \frac{28}{2}$ $a+5 = 14$ $a = 9$	1 Mark: Correct answer.
28(a) (iii)	$3 \times \left(\frac{4y}{3} + 3y - 5\right) = 0 \times 3$ $4y + 9y - 15 = 0$ $13y = 15$ $y = \frac{15}{13} \text{ or } 1\frac{2}{13}$	1 Mark: Correct answer.
28(b) (i)	$V = Ah$ $= 25 \times 10 \times 0.060 = 15 \text{ m}^3$ Now $1 \text{ m}^3 = 1 \text{ kL}$ $V = 15 \text{ kL} = 15 \text{ 000 L}$ 15000 litres of water fell on the shed.	2 Marks: Correct answer. 1 Mark: Finds the volume in terms of cubic metres.

28(b) (ii)	<p>Radius of the tank is 3 m</p> $V = \pi r^2 h$ $15 = \pi \times 3^2 \times h$ $h = \frac{15}{\pi \times 3^2}$ $= 0.530516477\dots$ $\approx 0.53 \text{ m (or 53 cm or 530 mm)}$ <p>The depth of the water is 0.53 m</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: Shows some understanding.</p>
28(c) (i)		1 Mark: Correct answer.
28(c) (ii)	Line of fit is drawn the above scatterplot.	1 Mark: Correct answer.
28(c) (iii)	High positive correlation.	1 Mark: Correct answer.
28(d)	<p>To find the difference in latitude.</p> $l = \frac{\theta}{360} \times 2\pi r$ $4356 = \frac{\theta}{360} \times 2 \times \pi \times 6400$ $\theta = \frac{4356 \times 360}{2 \times \pi \times 6400}$ $= 38.99693993\dots \approx 39^\circ$ <p>Latitude = $47^\circ\text{N} - 39^\circ = 8^\circ\text{N}$ Second city is 8°N.</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: Makes some progress towards the solution.</p>
28(e) (i)	<p>Total paid = $\\$1776 \times 26 \times 7$</p> $= \$323\,232$	1 Mark: Correct answer.
28(e) (ii)	<p>Interest = $\\$323\,232 - \\$204\,000$</p> $= \$119\,232$	1 Mark: Correct answer.

28(e) (iii)	$I = Prn$ $\$119232 = \$204000 \times r \times 7$ $r = \frac{\$119232}{\$204000 \times 7}$ $= 0.0834957\dots \approx 8.4\%$	1 Mark: Correct answer.
29(a)	<p>$r = 0.084 \div 12 = 0.0070$, $n = 4 \times 12 = 48$ months</p> <p>Intersection value is 40.64856</p> <p>Let the monthly repayment be x.</p> $\$16000 = 40.64856 \times x$ $x = \$393.6178797\dots \approx \393.62 <p>Total repaid = $48 \times \\$393.62 = \\18893.76</p> <p>Interest = $\\$18893.76 - \\$16000 = \\$2893.76$</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: Finds the intersection value or shows some understanding.</p>
29(b)	<p>Let P be the population of penguins</p> $\frac{50}{p} = \frac{20}{110}, p = 275$ <p>87% of Pop 2012 = 275</p> $0.87 \times \text{Pop 2012} = 275$ $\text{Pop 2012} = \frac{275}{0.87} \approx 316$	<p>2 Marks: Correct answer.</p> <p>1 Mark: Finds the number of penguins in 2013.</p>
29(c) (i)	A z-score of 2 is two standard deviations above the mean.	1 Mark: Correct answer.
29(c) (ii)	$z = \frac{x - \bar{x}}{s}$ $-2 = \frac{x - 64}{12.5}$ $x = (-2 \times 12.5) + 64 = 39$ <p>Hannah's mark is 39%</p>	1 Mark: Correct answer.
29(c) (iii)	$z = \frac{x - \bar{x}}{s}$ $= \frac{51.5 - 64}{12.5} = -1$ <p>Jacob's z-score is -1</p>	1 Mark: Correct answer.
29(c) (iv)	$z = \frac{x - \bar{x}}{s}$ $3 = \frac{x - 64}{12.5}$ $x = (3 \times 12.5) + 64 = 101.5$ <p>Lucy needs to score 101.5% in the test (impossible).</p>	1 Mark: Correct answer.

29(d)	$P(\text{HH or HT or TH}) = \frac{60}{100} \times \frac{60}{100} + \frac{60}{100} \times \frac{40}{100} + \frac{40}{100} \times \frac{60}{100}$ $= \frac{21}{25} \text{ or } 84\%$ <p>Alternatively $P(\text{Not TT}) = 1 - \left(\frac{40}{100} \times \frac{40}{100}\right) = \frac{21}{25}$</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: Shows some understanding of the problem.</p>																				
29(e)	<p>Call charge = $300 \times (0.35 + 0.45)$</p> <p>= \$240</p> <p>Free calls worth \$250.</p> <p>Monthly charge is \$79.00</p>	1 Mark: Correct answer.																				
29(f)	$2x - 3y = -1 \quad (1)$ $x + 2y = 10 \quad (2)$ <p>Multiply equation (2) by 2</p> $2x + 4y = 20 \quad (3)$ <p>Subtract equation (3) from equation (1)</p> $7y = 21$ $y = 3$ <p>Substitute $y = 3$ into equation (2)</p> $x + 2 \times 3 = 10$ $x = 4$ <p>Solution is $x = 4$ and $y = 3$ (4,3)</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: Finds the correct value for x or y. Alternatively makes some significant progress towards the solution.</p>																				
29(g)	<p>The increase in gym memberships has not caused life expectancy to increase. Life expectancy has risen in many advanced countries due to increase living standards. At the same time, people have become more health conscious about exercise and so would buy a gym membership. This strong relationship is correlational.</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: Shows some understanding.</p>																				
30(a)(i)	<table border="1"> <thead> <tr> <th>Class</th> <th>Class Centre</th> <th>Frequency</th> <th>Cum Freq</th> </tr> </thead> <tbody> <tr> <td>0-9</td> <td>4.5</td> <td>7</td> <td>7</td> </tr> <tr> <td>10-19</td> <td>14.5</td> <td>11</td> <td>18</td> </tr> <tr> <td>20-29</td> <td>24.5</td> <td>6</td> <td>24</td> </tr> <tr> <td>30-39</td> <td>34.5</td> <td>3</td> <td>27</td> </tr> </tbody> </table>	Class	Class Centre	Frequency	Cum Freq	0-9	4.5	7	7	10-19	14.5	11	18	20-29	24.5	6	24	30-39	34.5	3	27	1 Mark: Correct answer.
Class	Class Centre	Frequency	Cum Freq																			
0-9	4.5	7	7																			
10-19	14.5	11	18																			
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30-39	34.5	3	27																			
30(a)(ii)	27 friends were surveyed.	1 Mark: Correct answer.																				
30(a)(iii)	Modal class is 10-19	1 Mark: Correct answer.																				
30(a)(iv)	Mean $\bar{x} = 16.35185185...$ ≈ 16.4	1 Mark: Correct answer.																				

30(a)(v)	Population standard deviation $\sigma_n = 9.442628729...$ ≈ 9.4	1 Mark: Correct answer.														
30(a)(vi)	Less than 10 text messages = $\frac{7}{27} \times 100$ $\approx 25.9259259... \approx 26\%$	1 Mark: Correct answer.														
30(b)(i)	Leaking at 0.2 litres per minute implies $m = -0.2$ $V = mt + b$ $V = -0.2t + 4$	1 Mark: Correct answer.														
30(b)(ii)	$t = 150$ s or 2.5 min $V = -0.2t + 4$ $= -0.2 \times 2.5 + 4 = 3.5$ L	1 Mark: Correct answer.														
30(b)(iii)	$V = -0.2t + 4$ $0 = -0.2t + 4$ $0.2t = 4$ $t = 20$ min	1 Mark: Correct answer.														
30(c)	<p>3. A line (radial line) is drawn on the paper to reflect the line of sight to each corner.</p> <p>4. The distance from the table to each corner is measured using a trundle wheel or tape measure.</p> <p>5. The angle between each radial line is measured.</p>	<p>2 Marks: Correct answer.</p> <p>1 Mark: One correct statement or shows some understanding</p>														
30(d)(i)	<table border="1"> <tbody> <tr> <td>m</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>p</td> <td>0</td> <td>1</td> <td>3</td> <td>6</td> <td>10</td> <td>15</td> </tr> </tbody> </table>	m	1	2	3	4	5	6	p	0	1	3	6	10	15	1 Mark: Correct answer.
m	1	2	3	4	5	6										
p	0	1	3	6	10	15										
30(d)(ii)		1 Mark: Correct answer.														
30(d)(iii)	$m = \frac{1}{2}(p^2 - p) = \frac{1}{2} \times (7^2 - 7) = 21$ <p>The model predicts 21 matches for 7 players.</p>	1 Mark: Correct answer.														
30(d)(iv)	P represents the number of players. When there is one player there are no matches. Clearly p must be a positive whole number and negative values have no meaning.	1 Mark: Correct answer.														