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Centre Number

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Student Number

2014 HSC TRIAL EXAMINATION

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using blue or black pen
- Calculators may be used
- A formula sheet is provided at the back of this paper
- Write your Centre Number and Student Number at the top of this page, page 12 and on the multiple-choice answer sheet on page 32

Total Marks - 100

Section I Pages 2 - 11

25 marks

- Attempt Questions 1 - 25
- Allow about 30 minutes for this section

Section II Pages 12 - 28

75 marks

- Attempt Questions 26 - 30
- All questions are of equal value
- Allow about 120 minutes for this section.

Section 1 - 25 marks

Attempt Questions 1 – 25

Allow about 30 minutes for this section

Use the multiple-choice answer sheet provided.

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

Sample: $3 \times 4 =$ (A) 7 (B) 12 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ✗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word correct and drawing an arrow as follows.

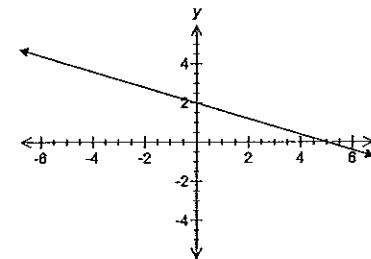
A ● B ✗ ^{correct} C ○ D ○

Disclaimer

Every effort has been made to prepare this Examination in accordance with the Board of Studies documents. No guarantee or warranty is made or implied that the Examination paper mirrors in every respect the actual HSC Examination question paper in this course. This paper does not constitute 'advice' nor can it be construed as an authoritative interpretation of Board of Studies intentions. No liability for any reliance, use or purpose related to this paper is taken. Advice on HSC examination issues is only to be obtained from the NSW Board of Studies. The publisher does not accept any responsibility for accuracy of papers which have been modified.

1. $3x - (2 - 5x)$ simplifies to?
- (A) $-6x + 15x^2$
 (B) $6x - 15x^2$
 (C) $8x - 2$
 (D) $-2 - 2x$
2. What is the interest earned on an investment of \$7500 for 5 years at 6.8% p.a., when the interest is compounded quarterly?
- (A) \$10421.20
 (B) \$2921.20
 (C) \$10507.04
 (D) \$3007.04
3. The fuel tank of a car holds 65L of fuel when full. On a trip the car uses 5.7L/100km of fuel.
- How far can the car travel on one full tank of fuel, correct to the nearest kilometre?
- (A) 1140 km
 (B) 9 km
 (C) 4 km
 (D) 37050 km
4. Sam enjoys playing a computer game. He has played 1400 games and won 56% of the games played. He wants to improve his success rate to 60%.
- How many games must he win in succession to achieve a success rate of 60%?
- (A) 56
 (B) 140
 (C) 1100
 (D) 1500

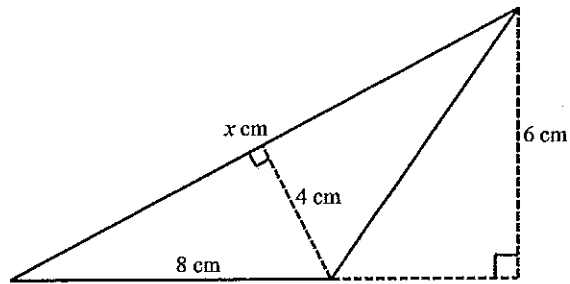
5. A spherical billiard ball has a volume of 65 cm^3 .
- If $V = \frac{4}{3}\pi r^3$, where V is the volume and r is the radius of a sphere, calculate the radius of the billiard ball, correct to 1 decimal place?
- (A) 4.5 cm
 (B) 2.3 cm
 (C) 2.5 cm
 (D) 3.9 cm
6. The equation of the line in the diagram below is;



- (A) $2y = 5x$
 (B) $y = \frac{2}{5}x + 2$
 (C) $y = \frac{5}{2}x + 2$
 (D) $y = -\frac{2}{5}x + 2$
7. Given $y = -x^2 + 5x - 3$, find y when $x = -2$
- (A) -17
 (B) -9
 (C) 3

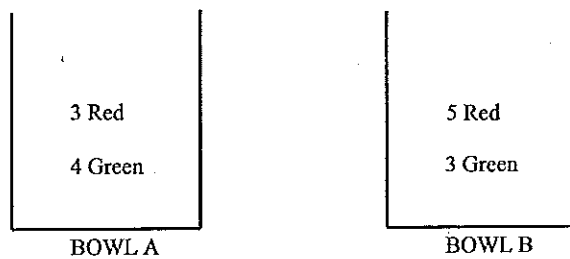
(D) -11

8. What is the value of x , in the diagram?



- (A) 20 cm
- (B) 16 cm
- (C) 12 cm
- (D) 8 cm

9.



Two bowls contain Red and Green marbles. BOWL A has 3 Red and 4 Green marbles and BOWL B has 5 Red and 3 Green Marbles.

One marble is selected from each bowl. What is the probability that both marbles are Red?

- (A) $\frac{1}{7}$
- (B) $\frac{5}{14}$
- (C) $\frac{59}{56}$

(D) $\frac{15}{56}$

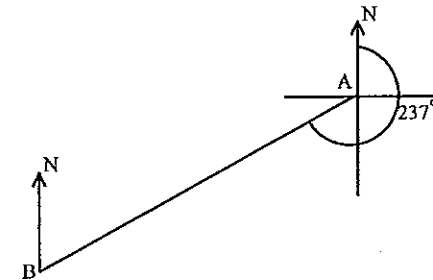
10. Saul kept a record of the value of his car as it depreciated over a 3 year period.

Year	Value at Start of the Year	Depreciation (18%)	Value at the end of the Year
1	\$30000	\$5400	\$24500
2	\$24500	\$4428	\$20172
3	\$20172	\$3631	\$16541

By what percentage of the new car price has Saul's vehicle depreciated by the end of the 3rd year, correct to the nearest percentage?

- (A) 18%
- (B) 45%
- (C) 54%
- (D) 55%

11.



A plane flies from A to B on a bearing of $237^\circ T$.

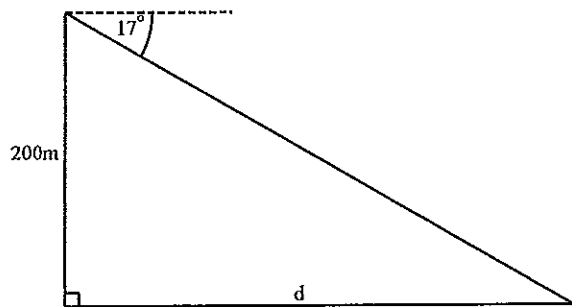
What is the bearing of A from B?

- (A) $237^\circ T$
- (B) $123^\circ T$
- (C) $057^\circ T$
- (D) $033^\circ T$

12. On a normal distribution, what is the percentage of scores that lie between -1 standard deviation and +2 standard deviations?

- (A) 68%
- (B) 81.5%
- (C) 84%
- (D) 95%

13.



What is the correct expression to find the value of 'd'?

- (A) $d = \frac{200}{\tan 17^\circ}$
- (B) $d = 200 \times \tan 17^\circ$
- (C) $d = \frac{200}{\cos 17^\circ}$
- (D) $d = 200 \times \sin 17^\circ$

14. How many committees of 4 students can be selected from a class of 15 students?

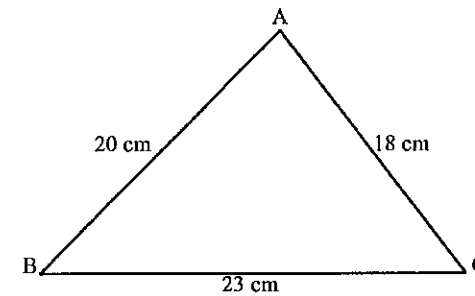
- (A) 3
- (B) 455
- (C) 1365
- (D) 10920

15. A plane is due to depart Singapore ($1^\circ N, 104^\circ E$) at 10.30 p.m., Wednesday local time.

What is the local time in Sydney ($34^\circ S, 151^\circ E$)?

- (A) 8.18 p.m. Wednesday
- (B) 12.48 a.m. Thursday
- (C) 7.22 p.m. Wednesday
- (D) 1.38 a.m. Thursday

16.



Identify the correct expression to find the smallest angle in the triangle ABC?

- (A) $\cos \theta = \frac{20^2 + 18^2 - 23^2}{2 \times 20 \times 18}$
- (B) $\cos \theta = \frac{20^2 + 23^2 - 18^2}{2 \times 20 \times 23}$
- (C) $\cos \theta = \frac{18^2 + 23^2 - 20^2}{2 \times 18 \times 23}$
- (D) $\cos \theta = \frac{20^2 + 23^2 + 18^2}{2 \times 20 \times 23}$

17. The probability of a school age child having defective eyesight is 0.12. In a school with an enrolment of 850 students, how many students would be expected to be diagnosed with eyesight that is not defective?

- (A) 102
(B) 646
(C) 730
(D) 748

18. A truck engine averages 2150 revolutions per minute on a return trip from Sydney to Perth. The total time for the trip is 48 hours and 48 minutes.

How many revolutions does the truck engine complete during the trip, expressing the answer in scientific figures (standard notation, correct to 2 significant figures).

- (A) 104920
(B) 1.0×10^5
(C) 6321000
(D) 6.3×10^6

19. Given the formula $s = ut + \frac{1}{2}at^2$, rearrange the formula with 'u' the subject.

- (A) $u = \frac{2s - at^2}{2t}$
(B) $u = \frac{s - at^2}{t}$
(C) $u = \frac{2s - at}{2}$
(D) $u = s - at$

20. Sasha purchases a new car with a cash price of \$19990. She pays a deposit of 20% of the cash price and monthly payments of \$544 per month for 3 years.

How much is the amount of interest paid by Sasha?

- (A) \$23582
(B) \$19584
(C) \$3592
(D) \$3998

21. The blood alcohol content (BAC) of a female's blood is given by the formula;

$$BAC_{female} = \frac{10N - 7.5H}{5.5M}, \text{ where}$$

N is the number of standard drinks consumed,

H is the number of hours of drinking and

M is the person's mass in kg.

Calculate the BAC of a female who consumed 5 standard drinks in 3 hours and weighs 52 kg, correct to 3 decimal places.

- (A) 0.044
(B) 0.096
(C) 0.056
(D) 3.934

22. Razik is investigating the ecosystem of a wetland area by estimating the number of frogs in a pond. He initially caught, tagged and released 35 frogs.

A month later he caught 27 frogs of which 15 were marked.

Approximately how many frogs are there in the pond?

- (A) 19
(B) 25
(C) 47
(D) 63

23. Sally has purchased a 16GB USB. The average size of each file Sally creates and saves is 876 KB.

Approximately how many files can Sally expect to save on her USB?

- (A) 1.4699×10^{10}
 (B) 19152
 (C) 14352
 (D) 19

24. Which of the following expressions represents a parabola?

- (A) $y = 3 + x^3$
 (B) $y = \frac{3}{x}$
 (C) $y = \frac{x}{3}$
 (D) $y = x^2 + 3$

25. If the cost of electricity is 27.25 cents/kWh, calculate the cost of 870 kWh.

- (A) \$23.71
 (B) \$237.08
 (C) \$215.33
 (D) \$\$21532.50

QATs

Quality Assessment Tasks

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Centre Number

Student Number

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2014 HSC TRIAL EXAMINATION

Section II
 General Mathematics

75 marks

Attempt Questions 26-30

Allow about 2 hours for this part

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Question 26 (15 marks)

- 26(a) Find the value of a , correct to two decimal places if $a^3 = 300000$. 2

- 26(b) Simplify $36x^4y^5 \div 20x^2y^3$. 2

26(c) A family drives from Sydney to Canberra in 2 hours and 40 minutes at an average speed of 90 km/h, then from Canberra to Wagga Wagga in 4 hours and 30 minutes at an average speed of 104 km/h.

(i) Calculate the total distance travelled by the family. 2

(ii) The car used 49 L of fuel for the trip. Calculate the average fuel consumption, in L/100km for the trip. Answer correct to 2 decimal places. 2

26 (d) Yoko purchased a new car for \$48000. After 3 years the car had retained 62% of its new car value.

(i) Find the value of the car at the end of 3 years. 1

26 (d) (ii) Yoko wished to find the annual depreciation rate of her car, using the declining balance formula.

She created the following expression to calculate the annual depreciation rate.

$$S = 48000(1-r)^3.$$

Substituting the value in (i) for S, calculate 'r' correct to one decimal place. 3

26(e) Soma has a phone plan with Optelphone that has a 20 cent connection fee and a charge of 27 cents for each 30 second block of time for the call.

(i) He makes a call that lasts for 6 minutes and 42 seconds.
Calculate the cost of the call. 2

(ii) If Soma is on a \$30 a month plan, what percentage of his plan remains after he completes the call? 1

Question 27 (15 marks)

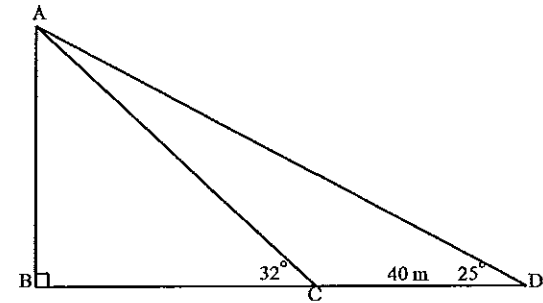
27(a) Solve the simultaneous equations:

$$\begin{aligned}x &= 2y + 7 \\ 2x + 3y &= -7\end{aligned}$$

3.

27(b)

The angle of elevation of a transmission tower from A is 25° . From a point C, 40 metres closer to the tower the angle of elevation is 32° .



(i) Explain why $\angle CAD = 7^\circ$.

1

(ii) Using the Sine rule in $\triangle CAD$, calculate the length of CA , correct to 3 significant figures.

3

(iii) Hence calculate the length of AB , correct to one decimal place.

2

27(c) A portion of a gas account is represented below.

Gas usage for period 24 Apr 2013 to 22 nd Jul 2013		
Old rate prorate: 24 Apr 2013 to 15 Jul 2013 (83 days)		
Gas consumption:	<u> C </u> MJ @ \$0.02377	\$118.92
	Next 8040.91MJ @ \$0.02228	\$179.51
Supply charge:		\$40.51
New rate prorate: 16 Jul 2013 to 22 Jul 2013 (7 days)		
Gas consumption:	422MJ @ \$0.02694	\$11.37
	Next 678.08 MJ @ \$0.02525	\$17.12
Supply charge:		\$3.87
	Total usage and supply charges:	\$370.98
	Total GST for new charges:	<u> A </u>
	Total amount due:	<u> B </u>

(i) Calculate, A, the GST (10%) to be paid on this account.

1

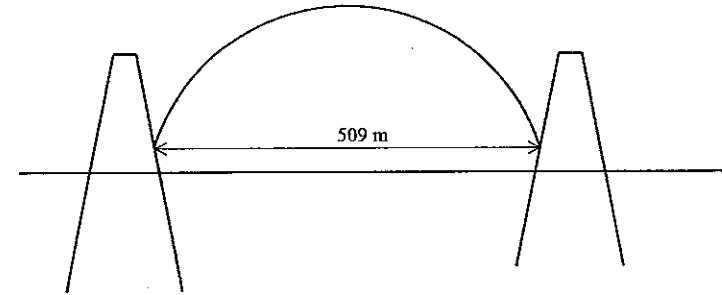
(ii) What amount is B - the total amount due for this account?

1

(iii) Calculate, C, the gas consumption on the old rate prorate, correct to the nearest MJ.

2

27(d) The length of the road on the Sydney Harbour Bridge between the two pylons is 509 metres, correct to the nearest metre.

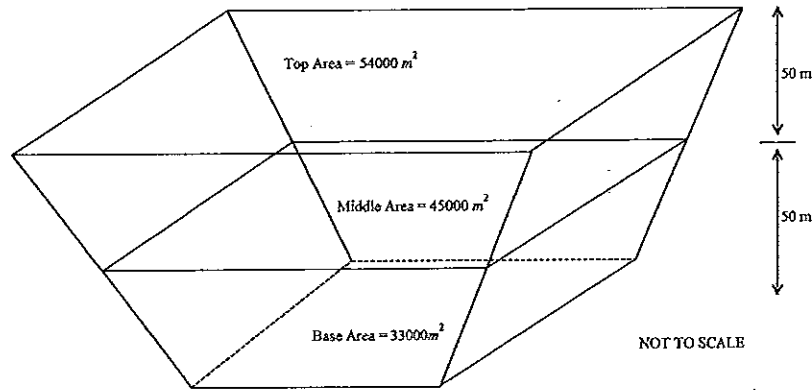


Calculate the percentage error of this measurement, correct to 2 significant figures.

2

Question 28 (15 marks)

28(a)



Ore is being mined from an open cut mine, as illustrated above.

- (i) Use Simpson's rule, for three values to calculate the volume of material that has been excavated from the mine.

2

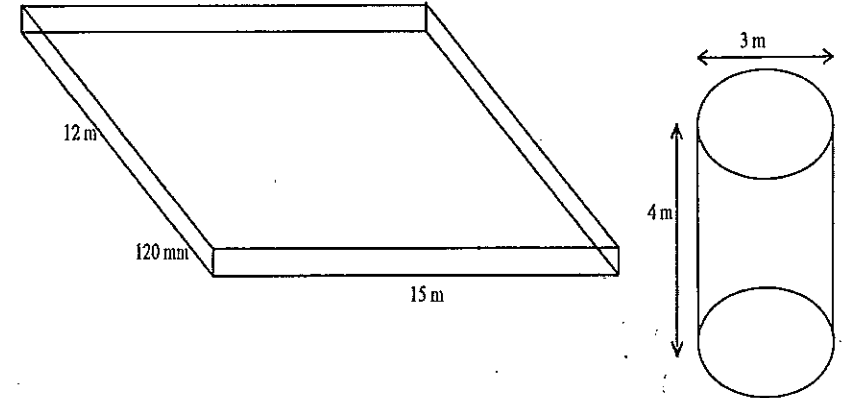
- (ii) Each cubic metre of material excavated from the open cut mine contains 45kg of ore.
Calculate the quantity of ore retrieved from the mine.

2

- (iii) If the ore is worth \$345 per tonne on the world market and it costs the company \$120 per tonne to extract the ore, what profit is made from extracting the ore from the mine?

1

28(b)



Jack and Jill are building an environmentally friendly house that has a flat roof in the shape of a rectangular prism as illustrated above. When rain falls on the roof, it is collected in a cylindrical water tank.

- (i) If rain falls to cover the roof to a depth of 120 mm, calculate the amount of water collected, in cubic metres.

2

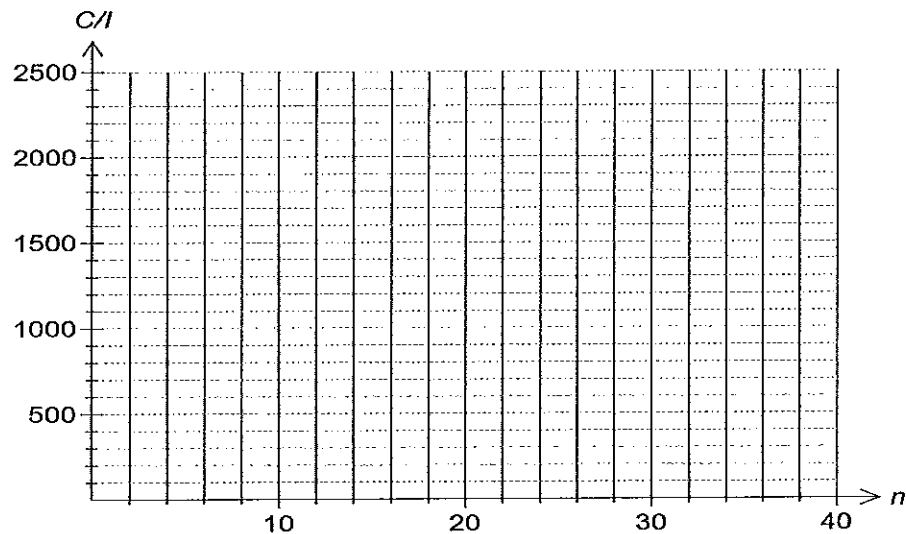
- (ii) If the tank is a new one, recently installed and empty, calculate the depth of water when all the water is collected from the roof, correct to 3 decimal places.

2

28 (c) Following her success on a TV cooking show, Hannah decides to open her own exclusive cake shop.

Following research, she calculates that the cost of producing cakes on any day can be calculated using the formula $C = 45n + 360$, where n is the number of cakes produced.

(i) On the axes provided, draw the graph of $C = 45n + 360$. 1



(ii) What is the gradient of the line? 1

(iii) What does the gradient represent? 1

(iv) On the axes graph the line $I = 63n$, where I represents the income Hannah earns selling her cakes. 1

(v) Find the number of cakes Hannah needs to make and sell to break even in her business. 1

(vi) On the graph shade the region that represents Hannah's profit. 1

Question 29

29(a) A patient is to receive 1.2 L of saline solution by intravenous drip. The solution is to be administered over a period of 5 hours.

If 1mL = 4 drops, how many drops/minute must the machine be set at for the patient to receive the 1.2L of saline solution.

3

29 (b) Time, T , varies inversely with the average speed, s , for a road trip. It takes a driver 24 hours to complete a road trip at an average speed of 60 km/h.

(i) Show that the constant of variation is 1440.

2

(iii) How long will the same trip take at an average speed of 80 km/h?

1

29(c) Jacko is playing a game that involves the rolling of a die. If the uppermost face shows an odd number he wins \$4. If it shows a 6 he will win \$10. If it shows a 2 or 4 he loses \$8.

Calculate Jacko's financial expectation from playing this game.

2

(d)

Period	Interest rate per period							
	1%	2%	3%	4%	5%	6%	7%	8%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	20.400	2.0500	2.0600	2.0700	2.0800
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938	8.6540	8.9228
8	8.2857	8.5830	8.8923	9.2142	9.5491	9.8975	10.2598	10.6366
9	9.3685	9.7546	10.1591	10.5828	11.0266	11.4913	11.9780	12.4876
10	10.4622	10.9497	11.4639	12.0061	12.5779	13.1808	13.8164	14.4866

(i) Michel decides to invest \$600 every 6 months into an investment plan at 8% p.a. interest compounded for 5 years.

Using the values in the table above, show how his investment will have grown to \$7203.66 after 5 years.

2

- (ii) Michel's aim is to have his investment reach a value of \$12000. How much more must Michel invest into his saving account to achieve a balance of \$12000? 3

- (iii) Michel changes his mind and decides to invest the balance from his investment in (i) at 10% p.a. compounded annually. He makes the following calculation to determine the time it will take for him to achieve his goal of \$12000.

$$12000 = 7203.66 \times (1.1)^n,$$

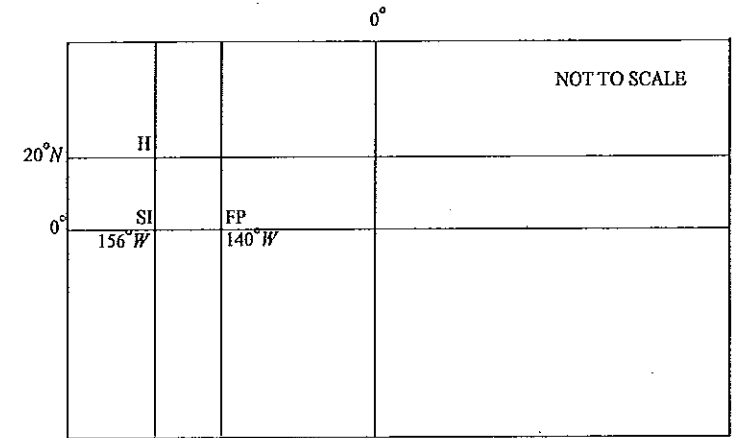
Where n is the number of years the money is invested for.

Substituting $n = 10$, Michel's calculation is $7203.66 \times (1.1)^{10} = 18684.44$, which is too high.

By substituting different values for n , find the number of years it will take for Michel achieve to his investment goal of \$12000. 2

Question 30

30(a)



A cruise ship sails from Hawaii (H) ($20^\circ N, 156^\circ W$) south to the Society Islands (SI) ($0^\circ, 156^\circ W$), then east along the Equator to French Polynesia (FP) ($0^\circ, 140^\circ W$). (SI)

- (i) Calculate the total distance sailed by the cruise ship, in kilometres. (use the radius of the Earth as 6400 km) 3

- (ii) If the cruise ship averages 41.5 km/h, calculate the time taken to sail from Hawaii to French Polynesia, correct to the nearest hour. 2

- 30 (b) The results of research between the average height of parents and the height of their children in a particular community, when they have achieved their maximum height as adults, is recorded in the table below.

	Correlation coefficient (r) = 0.7590	
	Mean	Standard deviation
Height of child (c)	169.55	5.384
Height of parent (p)	173.20	5.740

- (i) Calculate, correct to 4 decimal places, the gradient of the line of best fit using the formula; 2

$$\text{gradient} = \text{correlation coefficient} \times \frac{\text{standard deviation of p-scores}}{\text{standard deviation of c-scores}}$$

- (ii) Find the p-intercept, correct to 4 decimal places, using the formula; 2

$$\text{p-intercept} = \text{mean of p-values} - [\text{gradient} \times \text{mean of c-values}]$$

- (iii) Hence write down the equation of the straight line in the form $p = mc + q$, where m is the gradient from (i) and q is the intercept from (ii). 1

- (iv) Using the least-squares equation from (iii) find the expected average height of parents whose children are 169 cm. 2

- 30 (c) Researchers released the results for a new screening test to identify a particular virus. The results are shown in the table below.

	Positive test	Negative test	Total
Had the virus	195	49	244
Did not have the virus	28	228	256
	223	277	500

- (i) How many people had a false result to their test? 1

- (ii) Find the probability that the test was accurate. 1

- (iii) Find the probability that people who had the virus showed a positive test result. 1

Mathematics General

FORMULAE AND DATA SHEET

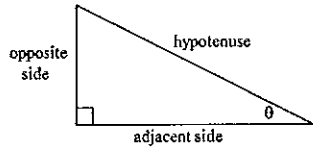
Financial Mathematics	Data Analysis
<p>Simple interest</p> $I = Prn$ <p>P is initial amount r is interest rate per period, expressed as a decimal n is number of periods</p> <p>Compound interest</p> $A = P(1+r)^n$ <p>A is the final amount P is the initial amount r is interest rate per period, expressed as a decimal n is the number of compounding periods</p> <p>Present value and future value</p> $PV = \frac{FV}{(1+r)^n} \quad FV = PV(1+r)^n$ <p>r is interest rate per period, expressed as a decimal n is the number of compounding periods</p> <p>Straight-line method of depreciation</p> $S = V_0 - Dn$ <p>S is the salvage value of asset after n periods V_0 is initial value of asset D is amount of depreciation per period n is number of periods</p> <p>Declining-balance method of depreciation</p> $S = V_0(1-r)^n$ <p>S is the salvage value of asset after n periods V_0 is initial value of asset r is the depreciation rate per period, expressed as a decimal n 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 x,</p> $z = \frac{x - \bar{x}}{s}$ <p>\bar{x} is the mean s is the standard deviation</p> <p>Outliers</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>Q_L is the lower quartile Q_U is the upper quartile IQR is interquartile range</p> <p>Least-squares line of best fit</p> $y = \text{gradient} \times x + y\text{-intercept}$ <p>$\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ score}}{\text{standard deviation of } x \text{ score}}$</p> <p>$y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$</p> <p>$r$ is the correlation coefficient \bar{x} is the mean of the x scores \bar{y} is the mean of the y scores</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

	<p>and 2</p> <ul style="list-style-type: none"> Approximately 99.7% of scores have z-scores between -3 and 3
<p>Spherical Geometry</p> <p>Circumference of a circle</p> $C = 2\pi r \quad \text{or} \quad C = \pi D$ <p>r is radius D is diameter</p> <p>Arc length</p> $l = \frac{\theta}{360} \times 2\pi r$ <p>r is radius θ is number of degrees in central angle</p> <p>Radius of Earth</p> <p>(taken as) 6400 km</p> <p>Time differences</p> <p>For calculation of time differences using longitude: $15^\circ = 1$ hour time difference</p>	<p>Surface Area</p> <p>Sphere</p> $A = 4\pi r^2$ <p>r is radius</p> <p>Closed Cylinder</p> $A = 2\pi r^2 + 2\pi rh$ <p>r is radius h is perpendicular height</p> <hr/> <p>Volume</p> <p>Prism or cylinder</p> $V = Ah$ <p>A is area of base h is perpendicular height</p> <p>Pyramid or cone</p> $V = \frac{1}{3}Ah$ <p>A is area of base h is perpendicular height</p> <hr/> <p>Volume and capacity</p> <p>Unit conversion: $1 \text{ m}^3 = 1000 \text{ L}$</p> <hr/> <p>Approximation Using Simpson's Rule Area</p> $A \approx \frac{h}{3}(d_f + 4d_m + d_l)$ <p>h is distance between successive measurements d_f is first measurement d_m is middle measurement d_l is last measurement</p> <p>Volume</p> $V \approx \frac{h}{3}\{A_L + 4A_M + A_R\}$ <p>h is distance between successive measurements</p>
<p>Circle</p> <p>Area</p> $A = \pi r^2$ <p>r is radius</p> <p>Sector</p> $A = \frac{\theta}{360} \pi r^2$ <p>r is radius θ is number of degrees in central angle</p> <p>Annulus</p> $A = \pi(R^2 - r^2)$ <p>R is radius of outer circle r is radius of inner circle</p> <p>Trapezium</p> $A = \frac{h}{2}(a+b)$ <p>h is perpendicular height a and b are lengths of parallel sides</p>	

Area of land and catchment areas

unit conversion: 1 ha = 10 000 m²

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 $\triangle ABC$,

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

Area of a triangle

In $\triangle ABC$,

$$A = \frac{1}{2} ab \sin C$$

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 byte = 8 bits

1 kilobyte = 2¹⁰ bytes = 1024 bytes

1 megabyte = 2²⁰ bytes = 1024 kilobytes

A_L is first measurement
 A_M is middle measurement
 A_R is last measurement

Blood Alcohol Content Estimates

$$BAC_{max} = \frac{10N - 7.5H}{6.8M}$$

or

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

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

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

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

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

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

1 gigabyte = 2³⁰ bytes = 1024 megabytes

1 terabyte = 2⁴⁰ bytes = 1024 megabytes

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

Gradient-intercept form

$$y = mx + b$$

m is gradient

b is y-intercept

2014 HSC TRIAL EXAMINATION

General Mathematics - Mapping Grid

Section I

Question	Solution	Answer
1	$3x - (2 - 5x) = 3x - 2 + 5x = 8x - 2$	C
2	$7500(1 + \frac{6.8\%}{4})^{20} - 7500 = 3000.04$	D
3	$\frac{65}{5.7} \times 100 = 1140 \text{ km}$	A
4	$\frac{784 + x}{1400 + x} = 0.6$ $784 + x = 0.6(1400 + x)$ $0.4x = 56$ $x = 140$	B
5	$65 = \frac{4}{3}\pi r^3$ $r = \sqrt[3]{\frac{65 \times 3}{4\pi}} = 2.494259... = 2.5 \text{ cm}$	C
6	$y = -\frac{2}{5}x + 2$	D
7	$y = -(-2)^2 + 5(-2) - 3 = -17$	A
8	$\frac{1}{2} \times 8 \times 6 = \frac{1}{2} \times x \times 4$ $24 = 2x$ $x = 12$	C
9	$P(2 \text{ Red}) = \frac{3}{7} \times \frac{5}{8} = \frac{15}{56}$	D
10	$100\% - \frac{16541}{30000} \times 100\% = 45\%$	B
11	$057^\circ T$	C
12	$34\% + \frac{1}{2} \times 95\% = 81.5\%$	B
13	$d = \frac{200}{\tan 17^\circ}$	A
14	${}^{15}C_4 = 1365$	C
15	$10.30 \text{ p.m.} + 3\text{h } 8\text{m} = 1.38\text{am Thursday}$	D

16	$\cos \theta = \frac{20^2 + 23^2 - 18^2}{2 \times 20 \times 23}$	B
17	$0.88 \times 850 = 748$	D
18	$2150 \times (48 \times 60 + 60) = 6321000 = 6.3 \times 10^6$	D
19	$s = ut + \frac{1}{2}at^2$ $2s = 2ut + at^2$ $2s - at^2 = 2ut$ $u = \frac{2s - at^2}{2t}$	A
20	$\text{Interest} = 0.2 \times 19990 + 544 \times 36 - 19990 = \3592	C
21	$BAC = \frac{10 \times 5 - 7.5 \times 3}{5.5 \times 52} = 0.096$	B
22	$\frac{15}{27} = \frac{35}{x}$ $x = \frac{27 \times 35}{15} = 63$	D
23	$16 \times 1024 \times 1024 + 128 = 19152$	B
24	$y = x^2 + 3$	D
25	$\frac{27.25 \times 870}{100} = \237.08	B

Disclaimer

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Section II

Question 26

26(a) (2 marks)

Outcomes Assessed: AM3

Targeted Performance Bands:

Criteria	Marks
• Find the correct root for a	1
• Round answer correctly	1

$$a^3 = 300000$$

$$a = \sqrt[3]{300000}$$

$$a = 66.94329501\dots$$

$$a = 66.94 \text{ (2d.p.)}$$

26(b) (2 marks)

Outcomes Assessed: AM3

Targeted Performance Bands:

Criteria	Marks
• Make sound effort to simplify correctly	1
• Achieve the correct answer	1

$$36x^4y^5 + 20x^2y^3$$

$$= \frac{36x^4y^5}{20x^2y^3} = \frac{9x^2y^2}{5}$$

26(c) (i) (2 marks)

Outcomes Assessed: MMI

Targeted Performance Bands:

Criteria	Marks
• Correct expression to find distance travelled	1
• Evaluate correctly	1

$$\text{Distance} = 2\frac{2}{3} \times 90 + 4\frac{1}{2} \times 104 = 708 \text{ km}$$

26 (c) (ii) (2 marks)

Outcomes Assessed: MMI

Targeted Performance Bands:

Criteria	Marks
• Correct expression to find fuel consumption	1
• Calculate answer correctly	1

$$\text{Fuel Consumption} = \frac{49}{7.08} \text{ L/100km} = 6.92 \text{ L/100km}$$

26(d) (i) (1 mark)

Outcomes Assessed: FSDr2

Targeted Performance Bands:

Criteria	Mark
• Acceptable effort to calculate value	1

$$\text{Value} = 62\% \times \$48000 = \$29760$$

26(d) (ii) (3 marks)

Outcomes Assessed: FSDr2

Targeted Performance Bands:

Criteria	Marks
• Correct manipulation of expression	1
• Sound effort to achieve correct answer	1
• Correct calculation and rounding off to required accuracy	1

$$29760 = 48000(1-r)^3$$

$$(1-r)^3 = \frac{29760}{48000}$$

$$1-r = \sqrt[3]{\frac{29760}{48000}}$$

$$r = 1 - \sqrt[3]{\frac{29760}{48000}} = 0.1472981017$$

$$r = 14.7\% \text{ p.a.}$$

26(e) (i) (2 marks)

Outcomes Assessed: FSCo1

Targeted Performance Bands:

Criteria	Marks
• Calculates cost of call	2

Number of 30 second blocks (or part thereof) = 14.

$$\text{Cost} = 14 \times 0.27 + 0.20 = \$3.98$$

26(e) (ii) (1 mark)

Outcomes Assessed: FSCo1

Targeted Performance Bands:

Criteria	Mark
• Calculates percentage of plan remaining	1

$$\text{Percentage remaining} = 100\% - \frac{3.98}{30} \times 100\% = 86.733333\dots\% = 87\%$$

Question 27

27(a) (3 marks)

Outcomes Assessed: AM3

Targeted Performance Bands:

Criteria	Marks
• Rearranges one of the equations correctly	1
• Calculates x or y	1
• Calculates second value	1

$$x = 2y + 7 \quad (1)$$

$$2x + 3y = -7 \quad (2)$$

In (1) $x = 2y + 7$ and substitute into (2)

$$2(2y + 7) + 3y = -7$$

$$4y + 14 + 3y = -7$$

$$7y = -21$$

$y = -3$ and substitute into $x = 2y + 7$

$$x = 2 \times -3 + 7$$

$$x = 1$$

$$\therefore x = 1, y = -3$$

27(b) (i) (1 mark)

Outcomes Assessed: MM5

Targeted Performance Bands:

Criteria	Mark
• Makes sound effort to find $\angle CAD$	1

$$\angle ACD = 180^\circ - 32^\circ \text{ (straight line } = 180^\circ)$$

$$\angle ACD = 148^\circ$$

$$\angle CAD = 180^\circ - (148^\circ + 25^\circ) \text{ (angle sum of a } \Delta = 180^\circ)$$

$$\angle CAD = 7^\circ$$

27(b) (ii) (3 marks)

Outcomes Assessed: MM5

Targeted Performance Bands:

Criteria	Marks
• Applies Sine Rule correctly	1
• Rearranges the Sine Rule to find CA	1
• Finds AC to required accuracy	1

$$\frac{40}{\sin 7^\circ} = \frac{AC}{\sin 25^\circ}$$

$$AC = \frac{40}{\sin 7^\circ} \times \sin 25^\circ$$

$$AC = 138.7119188$$

$$AC = 139m \text{ (2 sig. figs.)}$$

27(b) (iii) (2 marks)

Outcomes Assessed: MM5

Targeted Performance Bands:

Criteria	Marks
• Recognises application of the Sine ratio	1
• Calculates AB correctly	1

$$\sin 32^\circ = \frac{AB}{139}$$

$$AB = 139 \times \sin 32^\circ$$

$$AB = 73.65877773$$

$$AB = 73.7m \text{ (1 d.p.)}$$

27(c) (i) (1 mark)

Outcomes Assessed: FSRe3

Targeted Performance Bands:

Criteria	Mark
• Calculates GST (A)	1

$$GST = 10\% \times \$370.98 = \$37.10$$

27(c) (ii) (1 mark)

Outcomes Assessed: FSRe3

Targeted Performance Bands:

Criteria	Mark
• Calculates the amount due (B)	1

$$\text{Total of Gas Account} = \$370.98 + \$37.10 = \$408.08$$

27(c) (iii) (2 marks)

Outcomes Assessed: FSRe3

Targeted Performance Bands:

Criteria	Marks
• Correct expression to find gas used	1
• Calculates the correct quantity of gas consumed (C)	1

$$\text{Gas consumption} = \$118.92 \div \$0.02377 = 5002.944889 = 5003MJ$$

27(d) (2 marks)

Outcomes Assessed: MM1

Targeted Performance Bands:

Criteria	Marks
• Find the absolute error	1
• Calculates the percentage error to correct order of accuracy	1

Length of Sydney Harbour Bridge = 509 m

$$\text{Absolute Error} = \pm 0.5 \text{ m}$$

$$\begin{aligned} \text{Percentage Error} &= \frac{\pm 0.5}{509} \times 100\% \\ &= \pm 0.09823182711\% \\ &= \pm 0.10\% \text{ (2 sig. figs.)} \end{aligned}$$

Question 28

28(a) (i) (2 marks)

Outcomes Assessed: MM4

Targeted Performance Bands:

Criteria	Marks
• Applies Simpson's Rule correctly	1
• Calculates the volume excavated	1

$$\begin{aligned} \text{Volume of mine} &= \frac{50}{3} \{54000 + 4 \times 45000 + 33000\} \\ &= \frac{50}{3} \times 267000 = 4450000 \text{ m}^3 \end{aligned}$$

28(a) (ii) (2 marks)

Outcomes Assessed: MM4

Targeted Performance Bands:

Criteria	Marks
• Correct expression to calculate ore recovered	1
• Calculates the quantity of ore correctly	1

$$\text{Mass of ore} = \frac{4450000 \times 45}{1000} \text{ tonnes} = 200250 \text{ tonnes}$$

28(a) (iii) (1 mark)

Outcomes Assessed: MM4

Targeted Performance Bands:

Criteria	Mark
• Correct expression to calculate the value of the ore retrieved	1

Value of ore mined = $200250 \times \$345 - 200250 \times \$120 = \$45056250$

28(b) (i) (2 marks)

Outcomes Assessed: *MM4*

Targeted Performance Bands:

Criteria	Marks
• Correct expression for volume of water collected on roof	1
• Calculates the quantity of water	1

Volume of water collected on roof = $12 \times 15 \times 0.120 \text{ m}^3$
 $= 21.6 \text{ m}^3$

28(b) (ii) (2 marks)

Outcomes Assessed: *MM4*

Targeted Performance Bands:

Criteria	Marks
• Correct expression to calculate depth of water in tank	1
• Calculates the depth of water in tank	1

$V = \pi r^2 h$

$21.6 = \pi \times 1.2^2 \times h$

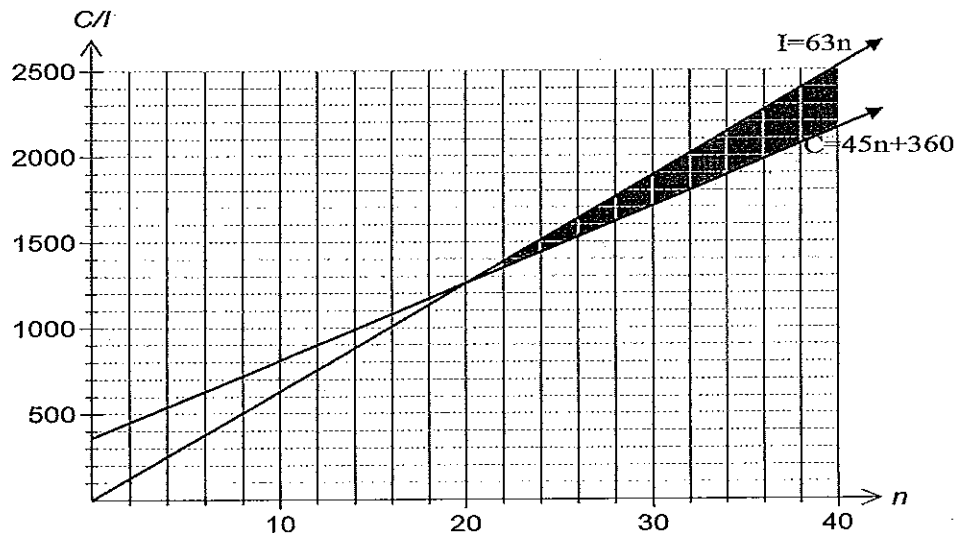
$h = \frac{21.6}{\pi \times 1.5^2} = 3.055774907$

$h = 3.056 \text{ m (3 d.p.)}$

28(c) (i) (1 mark)

Outcomes Assessed: *MM4*

Targeted Performance Bands:



28(c) (ii) (1 mark)

Outcomes Assessed: *MM4*

Targeted Performance Bands:

Criteria	Mark
• Identifies the gradient	1

Gradient = 45.

28(c) (iii) (1 mark)

Outcomes Assessed: *AM4*

Targeted Performance Bands:

Criteria	Mark
• Reasonable explanation for the value of the gradient	1

The gradient represents the cost of making each cake.

28(c) (iv) (1 mark)

Outcomes Assessed: *AM4*

Targeted Performance Bands:

Criteria	Mark
• Draws graph correctly	1

See graph.

28(v) (1 mark)

Outcomes Assessed: *AM4*

Targeted Performance Bands:

Criteria	Mark
• Finds the required number of cakes	1

let $63n = 45n + 360$

$18n = 360$

$\therefore n = 20$

Or reading from the graph, the break-even point is the point of intersection (20, 1260)

28(vi) (1 mark)

Outcomes Assessed: *AM4*

Targeted Performance Bands:

Criteria	Mark
• Shades correct region on graph	1

See graph for shaded region that represents profit.

Question 29

29(a) (3 marks)

Outcomes Assessed: FSHe2

Targeted Performance Bands:

Criteria	Marks
• Converts 1.2L to the correct number of blocks	1
• Correct expression to calculate dose	1
• Calculates the flow rate correctly	1

$$1.2 \text{ L} = 1200\text{mL} = 1200 \times 4 \text{ drops} = 4800 \text{ drops.}$$

$$\text{Number of drops per minute} = \frac{4800}{5 \times 60} = 16$$

Therefore 16 drops per minute will be the required flow rate.

29(b) (i) (2 marks)

Outcomes Assessed: AMS

Targeted Performance Bands:

Criteria	Marks
• Establishes correct inverse relationship	1
• Find the constant of variation	1

$$T \propto \frac{1}{S}$$

$$T = \frac{K}{S}$$

$$24 = \frac{K}{60}$$

$$K = 24 \times 60 = 1440$$

29(b) (ii) (1 mark)

Outcomes Assessed: AMS

Targeted Performance Bands:

Criteria	Mark
• Calculates the time for the road trip	1

$$T = \frac{1440}{S}$$

$$T = \frac{1440}{80} = 18 \text{ hours}$$

Therefore the time for the trip will be 18 hours.

29(c) (2 marks)

Outcomes Assessed: PB2

Targeted Performance Bands:

Criteria	Marks
• Correct expression for financial expectation	1
• Calculates the financial expectation	1

$$\begin{aligned} \text{Financial expectation} &= \frac{3}{6} \times \$4 + \frac{1}{6} \times \$10 - \frac{2}{6} \times \$8 \\ &= 2 + \frac{5}{3} - \frac{8}{3} = \$1.00 \end{aligned}$$

Financial expectation from playing this game will be a win of \$1.00.

29(d) (i) (2 marks)

Outcomes Assessed: FM5

Targeted Performance Bands:

Criteria	Marks
• Makes adjustments in values and selects correct multiplier	1
• Calculates correct investment value	1

$$P = \$600 \quad r = 8\% \text{ p.a.} = 4\% \text{ per half year} \quad n = 5 \text{ years} = 10 \text{ half years.}$$

$$\text{Multiplier, from table} = 12.0061$$

$$\text{Value of investment} = \$600 \times 12.0061 = \$7203.66$$

29(d) (ii) (3 marks)

Outcomes Assessed: FM5

Targeted Performance Bands:

Criteria	Marks
• Recognises need to divide by multiplier	1
• Calculates the investment value required	1
• Calculates the required adjustment in investment required	1

$$\text{Amount required to achieve } \$12000 = 12000 \div 12.0061 = \$999.49$$

$$\text{He will have to invest an extra } (\$999.49 - \$600) = \$399.49$$

29(d) (iii) (2 marks)

Outcomes Assessed: FM5

Targeted Performance Bands:

Criteria	Marks
• Rearranges expression	1
• Makes reasonable effort to find n	1

$$7203.66(1.1)^n = 12000$$

$$(1.1)^n = \frac{12000}{7203.66} = 1.665819875$$

$$\text{When } n = 5; (1.1)^5 = 1.61051 \dots$$

$$\text{When } n = 6; (1.1)^6 = 1.771561 \dots$$

Therefore he will achieve his investment amount in the 6th year.

Question 30

30(a) (i) (3 marks)

Outcomes Assessed: MM6

Targeted Performance Bands:

Criteria	Marks
• Makes effort to find the required changes in latitude and longitude	1
• Calculates the distance sailed	1
• Evaluates expression correctly	1

Change in latitude from Hawaii to Society Islands is 20° .

Change in longitude along the Equator is 16° .

As all changes are along great circles, the distance travelled is

$$= \frac{20}{360} \times 2 \times \pi \times 6400 + \frac{16}{360} \times 2 \times \pi \times 6400$$

$$= 4021 \text{ km}$$

30(a) (ii) (2 marks)

Outcomes Assessed: MM6

Targeted Performance Bands:

Criteria	Marks
• Correct expression to find time for the cruise	1
• Calculates the time correctly	1

$$\text{Time for cruise} = 4021 \div 41.5 = 96.89156627 \text{ hrs}$$

$$= 96 \text{ hours}$$

30(b) (i) (2 marks)

Outcomes Assessed: FSHel

Targeted Performance Bands:

Criteria	Marks
• Substitutes into given formula	1
• Calculates the gradient	1

$$\text{Gradient} = 0.7590 \times \frac{5.74}{5.384} = 0.80918 = 0.8092 \text{ (4 d.p.)}$$

30(b) (ii) (2 marks)

Outcomes Assessed: FSHel

Targeted Performance Bands:

Criteria	Marks
• Substitutes into given formula	1
• Calculates the p-intercept	1

$$\text{p-intercept} = 173.20 - 0.8092 \times 169.55 = 36.00014 = 36.0001$$

30(b) (iii) (1 mark)

Outcomes Assessed: FSHel

Targeted Performance Bands:

Criteria	Mark
• Writes the equation using calculated values	1

$$\text{Least squares equation: } p = 0.8092c + 36.0001$$

30(b) (iv) (2 marks)

Outcomes Assessed: FSHel

Targeted Performance Bands:

Criteria	Marks
• Substitutes into given formula	1
• Calculates p	1

When $c = 169$ and substituting into the equation in (iii)

$$p = 0.8092 \times 169 + 36.0001$$

$$p = 172.75 \text{ cm.}$$

Hence the average expected height of the parents will be 172.75 cm when the children's average height is 169 cm.

30(c) i) (1 mark)

Outcomes Assessed: FSHe1

Targeted Performance Bands:

Criteria	Mark
• Read table correctly	1

The number who had false results to their test = $49 + 28 = 77$.

30(c) (ii) (1 mark)

Outcomes Assessed: FSHe1

Targeted Performance Bands:

Criteria	Mark
• Uses values in table to calculate the probability	1

The probability that the test was accurate = $\frac{195 + 228}{500} = \frac{423}{500}$

30(c) (iii) (1 mark)

Outcomes Assessed: FSHe1

Targeted Performance Bands:

Criteria	Mark
• Selects correct value from table	1

The number who tested positive who actually had the virus = 195.