ACE Examinations

Student Name: _____

Practice Paper 6

**YEAR 12**

**YEARLY EXAMINATION**

# Mathematics General 2

**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



## 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

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1 The probability of an event occurring is $\frac{91}{100}$.

Which statement best describes the probability of this event?

(A) The event is unlikely to occur.
(B) The event is likely to occur.
(C) The event is certain to occur.
(D) The event will not occur.

2 Leah works a 38-hour week at a rate of $32.88 per hour. If she works at night Leah is paid a loading of $2.70 per hour. What is Leah's wage in a week where she works 38 hours of which 12 are at night?

(A) $1249.44
(B) $1281.84
(C) $1352.12
(D) $1644.00

3 The pre-GST cost of a mobile phone is $280. What is the GST payable on this mobile phone?

(A) $28
(B) $31
(C) $308
(D) $311

4 A mutual bank charges 0.04953% interest per day on the amount owing on a credit card. What is the interest charged in four weeks on a balance of $1800?

(A) $3.57
(B) $24.96
(C) $35.66
(D) $249.63

5 The table shows the monthly repayments per $1000 on a home loan.

| Term of loan | 6.00% | 6.25% | 6.50% | 6.75% |
|---|---|---|---|---|
| 5 | $19.33 | $19.45 | $19.57 | $19.68 |
| 10 | $11.10 | $11.23 | $11.35 | $11.48 |
| 15 | $8.44 | $8.57 | $8.71 | $8.85 |
| 20 | $17.16 | $7.31 | $7.46 | $7.60 |

What is the monthly repayment for a loan of $240 000 at 6.5% p.a. interest over 20 years?

(A) $7.46
(B) $17.94
(C) $1790.40
(D) $7460.00

6 Expand and simplify $6x^2(x^2-1)-2x^2$.

(A) $6x^4-2x^2-1$
(B) $6x^4+8x^2$
(C) $6x^4-8x^2$
(D) $9x^2$

7 What is the best description between education and life expectancy?

(A) Constant correlation.
(B) Negative correlation.
(C) Positive correlation.
(D) Zero correlation.

8 A 2400-watt heater is run for 6 hours each day. If electricity is charged at 26.3 c/kWh, what is the cost of running the heater for 8 days, to the nearest cent?

(A) $3.03
(B) $30.30
(C) $302.98
(D) $3029.76

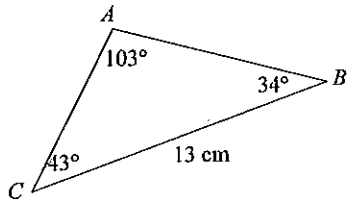




9 There are 24 competitors in a cycling race. How many different selections are possible for first and second place? Assume there are no dead heats.

(A) 47
(B) 276
(C) 552
(D) 576

10 What is the value $AC$, correct to one decimal place?



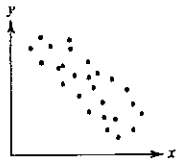

Not to scale

(A) 7.4 cm
(B) 7.5 cm
(C) 9.1 cm
(D) 10.7 cm

11 The amount of money in a fund is given by $A=600(1.1^t)$ where $A$ is the amount of money and $t$ is the time in years. What is the initial amount of money invested in the fund?

(A) $600
(B) $660
(C) $1000
(D) $1100

12 What is the correlation between the variables in this scatterplot?




(A) Low negative
(B) Low positive
(C) High negative
(D) High positive

**13** Georgia earns \$198 000 in a year. Her allowable deductions total \$22 000. Using the table below, which of the following expressions represents her 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) \$17 550 + \$4 000 × 0.37
(B) \$17 550 + \$96 000 × 0.37
(C) \$54 550 + \$18 000 × 0.45
(D) \$54 550 + \$40 000 × 0.45

**14** What is the angular distance (angle at the centre) between Yokohama (35°N, 139°E) and Darwin (35°N, 139°E)?
(A) 0°
(B) 70°
(C) 90°
(D) 139°

**15** Two unbiased coins are tossed together 30 times.
Which calculation shows the expected number of times you would get two heads?
(A) $\frac{1}{4}\times 30$
(B) $\frac{1}{2}\times 30$
(C) $\frac{1}{4}\times 60$
(D) $\frac{1}{2}\times 60$

**16** What is the amount of interest paid on a \$194 000 loan over 25 years if the interest rate is 6.7% p.a. compounding annually? Answer to the nearest dollar.
(A) \$78 755
(B) \$88 755
(C) \$787 549
(D) \$887 549





**17** The cost \$$C$ of a birthday party is given by $C = 50n + 135$ where $n$ is the number attending the party. If five people decide not to attend, by how much does the cost decrease?
(A) \$135
(B) \$185
(C) \$250
(D) \$385

**18** Zac is driving at a speed of 80 km/h. It takes Zac two seconds to react to a dangerous situation before applying the brakes. The stopping distance is given by the formula:

**Stopping distance:** $d = \frac{5Vt}{18} + \frac{V^2}{170}$

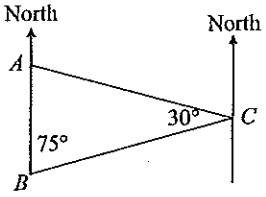
How far will Zac travel in his car after applying the brakes using this formula?
(A) 60 m
(B) 82 m
(C) 164 m
(D) 246 m

**19** A group of six students completed a test. The mean for the group on this test was 15. However one of the scores had been incorrectly recorded as a 10 instead of 20.
What is the correct mean?
(A) 16.5
(B) 16.7
(C) 17.3
(D) 18.3

**20** If $p = 2q^3 - 1$, what is the value of $q$ when $p$ is 13?
(A) $\sqrt[3]{6}$
(B) $\sqrt[3]{7}$
(C) $\sqrt[3]{14}$
(D) $\frac{\sqrt[3]{14}}{2}$

**21** Amy scored 80 in a mathematics test. The mathematics test had a mean of 64 and a standard deviation of 8. A recent English test had a mean of 60 and a standard deviation of 11. What mark in the English test would have been equivalent to Amy's maths mark?
(A) 76
(B) 78
(C) 80
(D) 82

**22** What is the bearing of $A$ from $C$?




Not to scale

(A) 030°T
(B) 075°T
(C) 255°T
(D) 285°T

**23** In a normally distributed set of scores, the mean is 74 and the standard deviation is 6. Approximately what percentage of the scores will lie between 62 and 86?

(A) 34%
(B) 68%
(C) 95%
(D) 99.7%

**24** Which equation correctly shows $r$ as the subject of $S = 500(1 - r)$?

(A) $r = \dfrac{500 - S}{500}$

(B) $r = \dfrac{S - 500}{500}$

(C) $r = 500 - S$

(D) $r = S - 500$

**25** Millie's car uses 7.25 litres per 100 km. How many litres of petrol will her car use on a trip of 310 km from Bulahdelah to Wollongong?

(A) 2.339 L
(B) 233.9 L
(C) 22.475 L
(D) 2247.5 L





## 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.

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**Question 26** (15 marks) **Marks**

(a) What is the value of $\sqrt{\dfrac{m+3n}{4n}}$ if $m = 5.9$ and $n = 2.4$? **2**

Answer correct to two significant places.

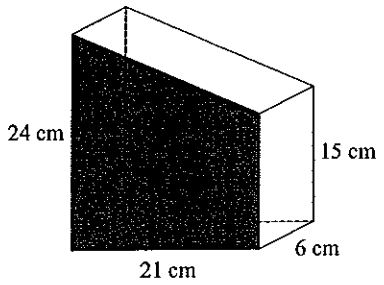
(b) A map has a scale of 1:400 000.

(i) Two towns are 2.5 cm apart on the map. **1**
What is the actual distance between the towns, in kilometres?

(ii) The distance between two cities is 60 km. **1**
How far apart are the two cities on the map, in centimetres?

(c) Medicine is given as a concentration of 200 mg per 100 mL. What is the dosage rate for this medicine in g/mL? **1**

(d) The magazine holder below has four sides and a base. It is open at the top.




Not to scale

(i) What is the area of the shaded side? 1

(ii) Calculate the surface area of the magazine holder. 1

(iii) The magazine holder is made from heavy duty cardboard. The cost of the cardboard is $4.29 per square metre. What is the cost of making fifty of these magazine holders? 2





(e) The table below shows the present value of a $1 annuity.

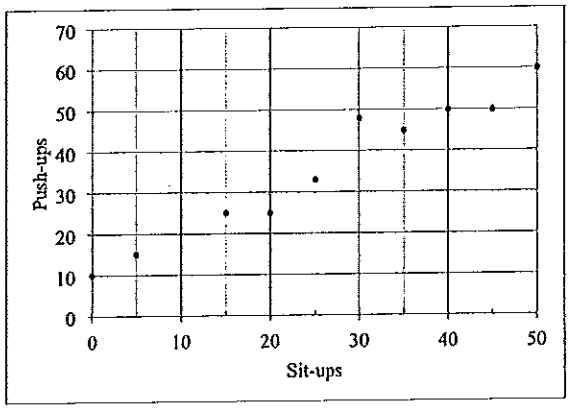
| Present value of $1 | | | | | |
|---|---|---|---|---|---|
| Period | 1% | 2% | 4% | 6% | 8% |
| 1 | 0.9901 | 0.9804 | 0.9615 | 0.9434 | 0.9259 |
| 2 | 1.9704 | 1.9416 | 1.8861 | 1.8334 | 1.7833 |
| 3 | 2.9410 | 2.8839 | 2.7751 | 2.6730 | 2.5771 |
| 4 | 3.9020 | 3.8077 | 3.6299 | 3.4651 | 3.3121 |
| 5 | 4.8534 | 4.7135 | 4.4518 | 4.2124 | 3.9927 |

(i) What would be the present value of a $9 000 per year annuity at 6% per annum for 5 years, with interest compounding annually? 1

(ii) An annuity of $6000 each three months is invested at 4% per annum, compounded quarterly for 1 year. What is the present value of the annuity? 1

(iii) What is the value of an annuity that would provide a present value of $43 230 after 3 years at 8% per annum compound interest? Answer to the nearest dollar. 1

(f) The scatterplot shows the number of sit-ups ($s$) and the number of push-ups ($p$) performed by ten students during a fitness test.




(i) Draw a line of best fit on the scatterplot. Find the gradient of this line. **1**

(ii) Alyssa was absent for the push-up test. Predict her push-up result if she scored 36 on the sit-up test. **1**

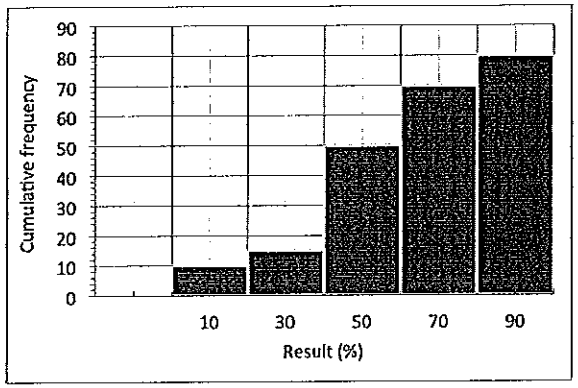
(iii) Calculate the value of the correlation coefficient. Answer correct to two decimal places. **1**





**Question 27** (15 marks) **Marks**

(a) The cumulative frequency histogram summarises the results of a test.




(i) How many people completed the test? **1**

(ii) What is the frequency of 50%? **1**

(iii) Construct a cumulative frequency polygon (or ogive) on this graph. **1**

(iv) Use the graph to estimate the median. **1**

(v) Use the graph to estimate the interquartile range. **1**

(b) A table of home loan repayments is shown below.

| | | | | |
|---|---|---|---|---|
| Amount borrowed | | \$390 000 | This table assumes the same number of days in each month. $I = Prn$ or $I = P \times \frac{r}{12}$ | |
| Annual interest rate (r) | | 6.15% | | |
| Monthly repayment (R) | | \$2100 | | |
| Month $n$ | Principal $P$ | Interest $I$ | $P + I$ | $P + I - R$ |
| 1 | \$390 000.00 | \$1998.75 | | |
| 2 | | | | |

(i) What is the value of $P + I - R$? **1**

(ii) How much interest is owed on the second month? Answer to the nearest cent. **2**

(c) Christopher has completed three mathematics tests. His mean mark is 69%. What percentage mark does he have to get in his next test to increase the mean to 70%? **2**





(d) Solve the following equations.

(i) $7x + 3 = 38$ **1**

(ii) $6(5m - 6) = 6m$ **1**

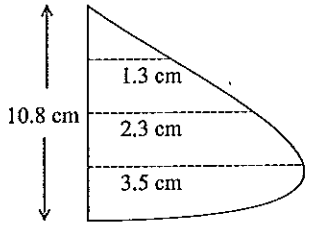
(iii) $\frac{1}{2}a + \frac{1}{4}a = 12$ **1**

(e) Jett weighs 75 kg and consumes five standard drinks in an hour. What is Jett's blood alcohol content? Answer correct to two decimal places. **2**

**Question 28** (15 marks) **Marks**

(a) The time taken ($t$, in hours) to complete a journey is inversely proportional to the speed ($s$, km/h). A car takes 4 hours to complete a journey at 65 km/h. Find the time taken to complete a journey if the car travels at 80 km/h. **2**

(b) The diagram shows the cross-section of an ornament with a length of 50 cm.




Not to scale

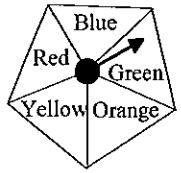
(i) Use Simpson's Rule twice to find an approximation for the area of the cross-section. Answer correct to one decimal place. **2**

(ii) Estimate the volume of the ornament. Answer to the nearest cubic metre. **1**





(c) The arrow on a regular pentagon is spun twice. The result is recorded as a blue, green, orange, yellow or a red. Behind two of the colours there is a prize of $500.




(i) What is the probability of winning $500 with the first spin? **1**

(ii) What is the probability of not winning $500 on the first spin but wining $500 on the second spin? **1**

(iii) What is the probability not winning $500 on both spins? **1**

(iv) What is the probability of winning at least $500 on both spins? **1**

(d) Aidan uses a 4 kilowatt per hour clothes dryer for a total of 4 hours. He is charged at a rate of 27.48 cents per kilowatt. What is the cost of using the clothes dryer? **2**

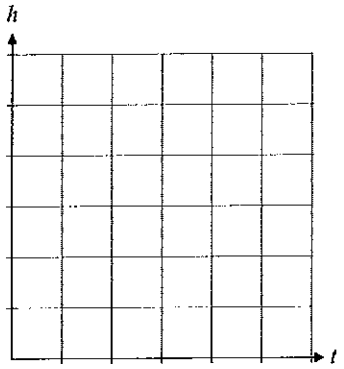
(e) Adam throws a ball and it takes 4 seconds to reach the ground. The height it reaches is given by the formula

$$h = -t^2 + 4t$$

(i) Complete the following table of values. **1**

| $t$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $h$ | | | | | |

(ii) Draw the graph of $h = -t^2 + 4t$ using the number plane below. **1**




(iii) What is the maximum height reached by the ball? **1**

(iv) When is the maximum height reached? **1**





**Question 29** (15 marks) **Marks**

(a) A table for \$200 000 at 7.25% p.a. reducible interest is shown below.

| **Loan period in years** | 15 | 20 | 25 | 30 |
|---|---|---|---|---|
| **Monthly repayments** | \$1825.73 | \$1580.75 | \$1445.61 | \$1364.35 |

(i) Find the total amount that must be repaid if the loan is taken over 20 years. **1**

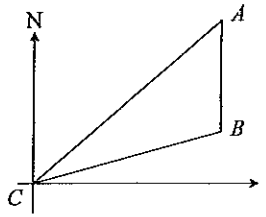
(ii) How much extra is repaid if the loan is taken over 30 years rather 20 years? **1**

(b) A truck is bought by a local council for \$120 000. It depreciates at 16% p.a.

(i) Calculate the value of the truck after 3 years using the declining balance formula. Answer correct to 2 decimal places. **1**

(ii) What is the percentage loss in value of the truck after 3 years? Answer correct to the nearest whole number. **1**

(c) Toby travels 27 km from point $C$ to point $A$ on a bearing of 049°T. He then changes direction and travels due south for 12 km to point $B$.




Not to scale

(i) What is the value of $\angle CAB$ ? **1**

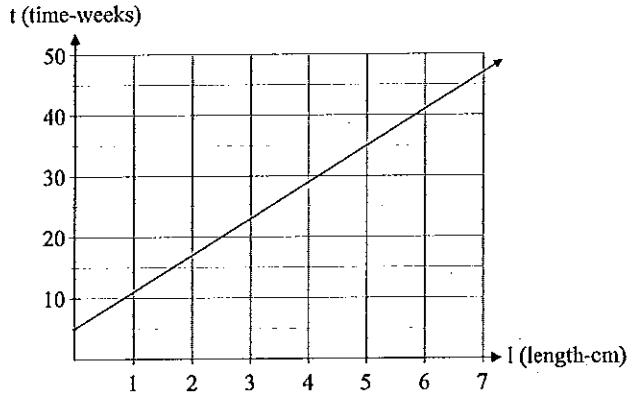
(ii) Find the distance from point $B$ to point $C$? **2**
Answer correct to 1 decimal place

(iii) What is the bearing of point $B$ from point $C$? **2**





(d) The graph shows the growth in the length of an earthworm.




(i) When was the initial length of the earthworm? **1**

(ii) Calculate the gradient of the line. **1**

(iii) What is the equation of this line? **1**

(e) The table below shows Lola's average water usage per day.

| Water usage | L/day |
|---|---|
| Shower | 35 |
| Washing machine | 32 |
| Toilet | 22 |
| Other | 16 |

(i) How much water is Lola using each day? 1

(ii) How much water would Lola use in a year? 1

(iii) What percentage of her water usage is for the toilet? Answer to the nearest whole number. 1





**Question 30** (15 marks) **Marks**

(a) A raffle ticket can be bought for $10 each. There are 100 tickets in the raffle. 2

First prize is $500 (1 ticket)
Second prize is $50 (5 tickets)
Mystery prize (1 ticket)

How much is the mystery prize for the raffle to be fair?

(b) Noosa in Queensland is located at (26°S, 153°E) and Pretoria in South Africa is located at (26°S, 28°E).

(i) What is the time difference between these places? 2

(ii) What is the time in Pretoria if it is 2 p.m. at Noosa? 1

(c) Pippa would like to estimate the number of toads in a swamp. She captured 36 toads, each one released after being tagged. When 25 toads were caught the following day it was found that 10 were tagged. What is an estimation of the toad population in the swamp? 2

(d) The ages of the residents who live in Hudson Creek are normally distributed. The mean age is 56 years and the standard deviation is 14. What percentage of the residents are younger than 70? **2**

(e) A water tank is the shape of closed cylinder with a radius of 1.4 m and a height of 1.9 m.

(i) Determine the maximum volume of the water tank. Answer correct to three decimal places. **1**

(ii) What is the capacity of the tank to the nearest litre? **1**

(f) Solve the pair of simultaneous equations using the substitution method. **2**

$$5x - y = 20$$
$$3x - 4y = 12$$





(g) The angle of elevation from a boat out to sea to the top of a 220-metre cliff is 37°. After travelling directly towards the cliff the angle of elevation from the boat to the top of the cliff is 56°. How far did the boat travel towards the cliff? Answer correct to the nearest metre. **2**

**End of paper**

# FORMULAE AND DATA SHEET

## Financial Mathematics

**Simple interest**

$$I = Prn$$

- $P$ is initial amount
- $r$ is interest rate per period, expressed as a decimal
- $n$ is number of periods

**Compound interest**

$$A = P(1+r)^n$$

- $A$ is final amount
- $P$ is initial amount
- $r$ is interest rate per period, expressed as a decimal
- $n$ is number of compounding periods

**Present value and future value**

$$PV = \frac{FV}{(1+r)^n}, \quad FV = PV(1+r)^n$$

- $r$ is interest rate per period, as expressed as a decimal
- $n$ is number of compounding periods

**Straight-line method of depreciation**

$$S = V_0 - Dn$$

- $S$ is 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

**Declining-balance method of depreciation**

$$S = V_0(1-r)^n$$

- $S$ is salvage value of asset after $n$ periods
- $V_0$ is initial value of asset
- $r$ is depreciation rate per period, expressed as a decimal
- $n$ is number of periods

## Data Analysis

**Mean of a sample**

$$\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$$

**z-score**

For any score $x$,

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

- $x$ is mean
- $s$ is standard deviation

**Outlier(s)**

score(s) less than $Q_L - 1.5 \times IQR$ or

score(s) more than $Q_U + 1.5 \times IQR$

- $Q_L$ is lower quartile
- $Q_U$ is upper quartile
- $IQR$ is interquartile range

**Least-squares line of best fit**

$$y = \text{gradient} \times x + y\text{-intercept}$$

$$\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$$

$$y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$$

- $r$ is correlation coefficient
- $\bar{x}$ is mean of $x$ score
- $\bar{y}$ is mean of $y$ scores

**Normal distribution**

- pproximately 68% of scores have $z$-scores between –1 and 1
- pproximately 95% of scores have $z$-scores between –2 and 2
- pproximately 99.7% of scores have $z$-scores between –3 and 3





## Spherical Geometry

**Circumference of a circle**

$$C = 2\pi r \text{ or } C = \pi d$$

- $r$ is radius
- $d$ is diameter

**Arc length of a circle**

$$l = \frac{\theta}{360} 2\pi r$$

- $r$ is radius
- $\theta$ is number of degrees in central angle

**Radius of Earth**

(taken as) 6400 km

**Time differences**

For calculation of time differences using longitude: 15° = 1 hour time difference

## Area

**Circle**

$$A = \pi r^2$$

- $r$ is radius

**Sector**

$$A = \frac{\theta}{360} \pi r^2$$

- $r$ is radius
- $\theta$ is number of degrees in central angle

**Annulus**

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

- $R$ is radius of outer circle
- $r$ is radius of inner circle

**Trapezium**

$$A = \frac{h}{2}(a+b)$$

- $h$ is perpendicular height
- $a$ and $b$ are the lengths of the parallel sides

**Area of land and catchment areas**

unit conversion: 1 ha = 10 000 $m^2$

## Surface Area

**Sphere**

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

- $r$ is radius

**Closed cylinder**

$$A = 2\pi r^2 + 2\pi rh$$

- $r$ is radius
- $h$ is perpendicular height

## Volume

**Prism or cylinder**

$$V = Ah$$

- $r$ is radius
- $h$ is perpendicular height

**Pyramid or cone**

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

- $A$ is area of the base
- $h$ is perpendicular height

**Volume and capacity**

unit conversion: 1 $m^3$ = 1000 L

## Approximation Using Simpson's Rule

**Area**

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

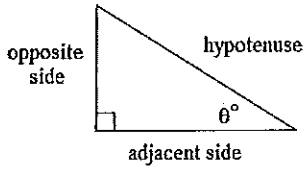
- $h$ distance between successive measurements
- $d_f$ is first measurement
- $d_m$ is middle measurement
- $d_l$ is last measurement

**Volume**

$$V \approx \frac{h}{3}(A_L + 4A_m + A_R)$$

- $h$ distance between successive measurements
- $A_L$ is area of left end
- $A_M$ is area of middle
- $A_R$ is area of right end

## 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 $\Delta ABC$

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

**Cosine rule**

In $\Delta ABC$

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

or

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

## Units of Memory and File Size

1 byte = 8 bits

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

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

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

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

## Blood Alcohol Content Estimates

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

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

$N$ is number of standard drinks consumed
$H$ is number of hours of drinking
$M$ is person's mass in kilograms

## Distance, Speed and Time

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

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

$$\text{stopping distance} = \begin{Bmatrix}\text{reaction-time}\\ \text{distance}\end{Bmatrix} + \begin{Bmatrix}\text{braking}\\ \text{distance}\end{Bmatrix}$$

## 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 6

## HSC Mathematics General 2 Yearly Examination

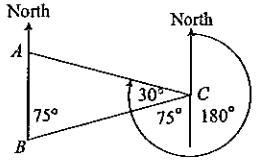
## Worked solutions and marking guidelines

| Section 1 | | |
|---|---|---|
| | **Solution** | **Criteria** |
| 1 | The event is likely to occur. | 1 Mark: B |
| 2 | Wage $= 38\times 32.88 + 12\times 2.70$<br>$= \$1281.84$ | 1 Mark: B |
| 3 | GST $= 10\%$ of $\$280$<br>$= 0.10\times \$280$<br>$= \$28$ | 1 Mark: A |
| 4 | Interest $= \dfrac{0.04953}{100}\times \$1800\times 28$<br>$= \$24.96$ | 1 Mark: B |
| 5 | $r = 6.50\%$, $n = 20$ years<br>Intersection value is \$7.46<br>Monthly repayment $= \$7.46\times 240$<br>$= \$1790.40$ | 1 Mark: C |
| 6 | $6x^2(x^2-1) - 2x^2 = 6x^4 - 6x^2 - 2x^2$<br>$= 6x^4 - 8x^2$ | 1 Mark: C |
| 7 | A rise in education results in a rise in life expectancy.<br>Positive correlation. | 1 Mark: C |
| 8 | Electricity $= 2.4\times 6$<br>$= 14.4$ kWh<br>Cost $= \$0.2630\times 14.4\times 8$<br>$= \$30.2976$<br>$\approx \$30.30$ | 1 Mark: B |
| 9 | Number of selections $= 24\times 23$<br>$= 552$ | 1 Mark: C |
| 10 | $\dfrac{AC}{\sin 34^\circ} = \dfrac{13}{\sin 103^\circ}$<br>$AC = \dfrac{13\times \sin 34^\circ}{\sin 103^\circ}$<br>$= 7.46072566 \approx 7.5$ cm | 1 Mark: B |





| | | |
|---|---|---|
| 11 | $A = 600(1.1^t)$<br>$= 600(1.1^0)$<br>$= 600$ | 1 Mark: A |
| 12 | Negative low relationship. Correlation between 0 and –0.5.<br>Low negative | 1 Mark: A |
| 13 | Tax payable = \$198 000 – \$22 00 = \$176 000<br>Taxable income between \$80 001 and \$180 000 (4th line)<br>\$17 550 + \$96 000 × 0.37 | 1 Mark: B |
| 14 | Latitude difference $= 35^\circ + 35^\circ$<br>$= 70^\circ$ | 1 Mark: B |
| 15 | $P(HH) = \dfrac{1}{2}\times\dfrac{1}{2} = \dfrac{1}{4}$<br>Expected outcomes $= P(E)\times$ Number of trials<br>$= \dfrac{1}{4}\times 30$ | 1 Mark: A |
| 16 | $A = P(1+r)^n$ $\quad I = A - P$<br>$= 194000(1+0.067)^{25}$ $\quad = \$981549 - \$194000$<br>$= \$981549.52$ $\quad = \$787549$ | 1 Mark: C |
| 17 | Cost for each person is \$50 ($C = 50n + 135$)<br>Cost decrease $= 5\times \$50$<br>$= \$250$ | 1 Mark: C |
| 18 | $d = \dfrac{5Vt}{18} + \dfrac{V^2}{170}$<br>$= \dfrac{5\times 80\times 2}{18} + \dfrac{80^2}{170}$<br>$= 82.09150327$<br>$\approx 82$ m | 1 Mark: B |
| 19 | Mean $= \dfrac{\text{Sum of scores}}{\text{Number of scores}}$ or $15 = \dfrac{\text{Sum of scores}}{6}$<br>Sum of scores $= 90$<br>Mean $= \dfrac{\text{Sum of scores}}{\text{Number of scores}}$<br>$= \dfrac{90+10}{6} = 16.66666\ldots \approx 16.7$ | 1 Mark: B |
| 20 | $13 = 2q^3 - 1$<br>$2q^3 = 14$<br>$q = \sqrt[3]{7}$ | 1 Mark: B |

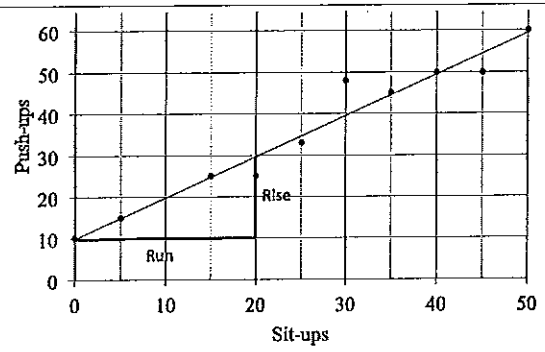
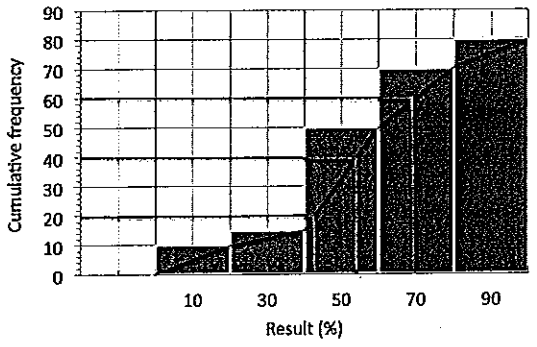
| | | |
|---|---|---|
| 21 | Mathematics $z$-score<br>$z=\frac{x-\bar{x}}{s}=\frac{80-64}{8}=2$<br>Equivalent score in the English test has the same $z$-score.<br>$z=\frac{x-\bar{x}}{s}$<br>$2=\frac{x-60}{11}$<br>$22=x-60$<br>$x=82$ | 1 Mark: D |
| 22 | Bearing of $A$ from $C$<br>$=30°+75°+180°$<br>$=285°\text{T}$<br>  | 1 Mark: D |
| 23 | $z=\frac{x-\bar{x}}{s}$ and $z=\frac{x-\bar{x}}{s}$<br>$=\frac{62-74}{6}$ $=\frac{86-74}{6}$<br>$=-2$ $=2$<br>95% of scores have a $z$-score between –2 and 2 | 1 Mark: C |
| 24 | $S=500(1-r)$<br>$\frac{S}{500}=(1-r)$<br>$r=1-\frac{S}{500}$<br>$=\frac{500-S}{500}$ | 1 Mark: A |
| 25 | $\text{Fuel Consumption}=\frac{\text{Amount of fuel}\times 100}{\text{Distance travelled}}$<br>$7.25=\frac{V\times 100}{310}$<br>$V=\frac{7.25\times 310}{100}$<br>$=22.475\text{ L}$ | 1 Mark: C |





**Section II**

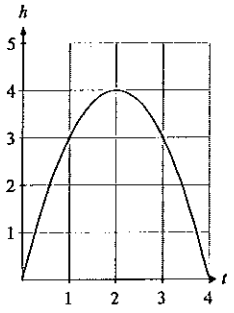
| | Solution | Criteria |
|---|---|---|
| 26(a) | $\sqrt{\frac{m+3n}{4n}}=\sqrt{\frac{5.9+3\times 2.4}{4\times 2.4}}$<br>$=1.168153814...$<br>$\approx 1.2$ | 2 Marks: Correct answer.<br>1 Mark: Substitutes $m=5.9$ & $n=2.4$ |
| 26(b) (i) | Actual distance $=2.5\times 400\,000$ cm<br>$=1\,000\,000$ cm $=10$ km | 1 Mark: Correct answer. |
| 26(b) (i) | Real distance $=\frac{6\,000\,000}{400\,000}$ cm<br>$=15$ cm | 1 Mark: Correct answer. |
| 26(c) | 200 mg/100 mL $=\frac{200\text{ mg}}{100\text{ mL}}$<br>$=\frac{200}{100}\times\frac{0.001\text{ g}}{\text{mL}}=0.002$ g/mL | 1 Mark: Correct answer. |
| 26(d) (i) | Shaded side is a trapezium<br>$A=\frac{1}{2}(a+b)h$<br>$=\frac{1}{2}\times(24+15)\times 21=409.50\text{ cm}^2$ | 1 Mark: Correct answer. |
| 26(d) (ii) | $SA=(2\times 409.5)+(24\times 6)+(21\times 6)+(15\times 6)$<br>$=1179\text{ cm}^2$ | 1 Mark: Correct answer. |
| 26(d) (iii) | $1\text{ m}^2=10000\text{ cm}^2$ hence $1179\text{ cm}^2=0.1179\text{ m}^2$<br>Cost $=0.1179\times\$4.29\times 50$<br>$=\$25.28955$<br>$\approx\$25.29$<br>The cost of fifty magazine holders is \$25.29 | 2 Marks: Correct answer.<br>1 Mark: Converts surface area to $\text{m}^2$ or shows some understanding. |
| 26(e) (i) | Intersection value is 4.2124 (6% and 5 years)<br>$PV=4.2124\times 9000$<br>$=\$37\,911.60$ | 1 Mark: Correct answer. |
| 26(e) (ii) | Intersection value is 3.9020 (1% and 4 years)<br>$PV=3.9020\times 6000$<br>$=\$23\,412$ | 1 Mark: Correct answer. |
| 26(e) (iii) | Intersection value is 2.5771 (8% and 3 years)<br>$43230=x\times 2.5771$<br>$x=\frac{43230}{2.5771}=\$16774.6692\approx\$16\,775$<br>Value of the annuity is \$16 775 per year. | 1 Mark: Correct answer. |

| | | |
|---|---|---|
| 26(f) (i) |  <br>$m=\frac{\text{Rise}}{\text{Run}}=\frac{20}{20}=1$ | 1 Mark: Correct answer. |
| 26(f) (ii) | When $s=36$ then $p=46$ (from the scatterplot)<br>Alyssa should score 46 on the push-up test. | 1 Mark: Correct answer. |
| 26(f) (iii) | Correlation coefficient $r=0.9770764854\ldots$ (calculator)<br>$\approx 0.98$ | 1 Mark: Correct answer. |
| 27(a) (i) | There were 80 people who completed the text. | 1 Mark: Correct answer. |
| 27(a) (ii) | Frequency of 50% is 35 (50 – 15). | 1 Mark: Correct answer. |
| 27(a) (iii) |  | 1 Mark: Correct answer. |
| 27(a) (iv) | There are 80 people, so the median is 40th person.<br>Median is approximately 54 (from the graph) | 1 Mark: Correct answer. |
| 27(a) (v) | There are 80 people, so $Q_3$ is 60th person. $Q_3=70$<br>There are 80 people, so $Q_1$ is 20th person. $Q_1=42$<br>$IQR=Q_3-Q_1=70-42=28$ | 1 Mark: Correct answer. |
| 27(b) (i) | $P+I-R=\$390000+\$1998.75-\$2100$<br>$=\$389898.75$ | 1 Mark: Correct answer. |



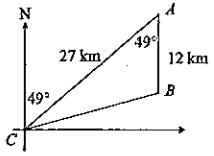


| | | |
|---|---|---|
| 27(b) (ii) | $I=Prn$<br>$=\$389898.75\times 0.0615\times\frac{1}{12}$<br>$=\$1998.231094\ldots$<br>$\approx\$1998.23$<br>Interest owed in the second month is \$1998.23 | 2 Marks: Correct answer.<br>1 Mark: Substitutes $r=0.0615$ or $n=\frac{1}{12}$ into the SI formula. |
| 27(c) | Mean $=\frac{\text{Sum of scores}}{\text{Number of scores}}$ Mean $=\frac{\text{Sum of scores}}{\text{Number of scores}}$<br>$69=\frac{\text{Sum of scores}}{3}$ $70=\frac{\text{Sum of scores}}{4}$<br>Sum of scores = 207 Sum of scores = 280<br>Christopher needs a mark of 73% (280 – 207). | 2 Marks: Correct answer.<br>1 Mark: Makes progress towards the solution. |
| 27(d) (i) | $7x+3=38$<br>$7x=35$<br>$x=\frac{35}{7}=5$ | 1 Mark: Correct answer. |
| 27(d) (ii) | $6(5m-6)=6m$ $6(5m-6)=6m$<br>$5m-6=m$ $30m-36=6m$<br>$4m-6=0$ $24m-36=0$<br>$4m=6$ $24m=36$<br>$m=\frac{6}{4}=1\frac{1}{2}$ $m=\frac{36}{24}=1\frac{1}{2}$ | 1 Mark: Correct answer. |
| 27(d) (iii) | $4\times\left(\frac{1}{2}a+\frac{1}{4}a\right)=12\times 4$ or $\frac{1}{2}a+\frac{1}{4}a=12$<br>$2a+a=48$ $\frac{3}{4}a=12$<br>$3a=48$ $3a=48$<br>$a=16$ $a=16$ | 1 Mark: Correct answer. |
| 27(e) | $BAC_{Male}=\frac{(10N-7.5H)}{6.8M}$<br>$=\frac{(10\times 5-7.5\times 1)}{6.8\times 75}=0.083333\ldots\approx 0.08$ | 2 Marks: Correct answer.<br>1 Mark: Substitutes into formula. |
| 28(a) | $t=\frac{k}{s}$ $t=\frac{260}{s}$<br>$4=\frac{k}{65}$ $=\frac{260}{80}$<br>$k=260$ $=3.25$ h or 3 h 15 min | 2 Marks: Correct answer.<br>1 Mark: Finds the value of $k$ or shows some understanding |

| | | |
|---|---|---|
| 28(b) (i) | Width of the equal parts is $10.8 \div 4 = 2.7$ cm<br>$A = \frac{h}{3}(d_f + 4d_m + d_l) + \frac{h}{3}(d_f + 4d_m + d_l)$<br>$= \frac{2.7}{3}(0 + 4\times 3.5 + 2.3) + \frac{2.7}{3}(2.3 + 4\times 1.3 + 0)$<br>$= 21.42 \text{ cm}^2 \approx 21.4 \text{ cm}^2$ | 2 Marks: Correct answer.<br>1 mark: Makes some progress using Simpson's rule. |
| 28(b) (ii) | $V = Ah$<br>$= 21.4 \times 50$<br>$= 1070 \text{ cm}^3$<br>Volume of the ornament is $1070 \text{ cm}^3$ | 1 Mark: Correct answer. |
| 28(c) (i) | $P(W) = \frac{2}{5}$ | 1 Mark: Correct answer. |
| 28(c) (ii) | $P(LW) = \frac{3}{5}\times\frac{2}{5} = \frac{6}{25}$ | 1 Mark: Correct answer. |
| 28(c) (iii) | $P(LL) = \frac{3}{5}\times\frac{3}{5} = \frac{9}{25}$ | 1 Mark: Correct answer. |
| 28(c) (iv) | $P(E) = 1 - P(LL)$ or $P(E) = P(WW)+P(LW)+P(WL)$<br>$= 1 - \frac{9}{25}$ or $= \frac{4}{25}+\frac{6}{25}+\frac{6}{25}$<br>$= \frac{16}{25}$ $= \frac{16}{25}$ | 1 Mark: Correct answer. |
| 28(d) | Electricity $= 4\times 4$<br>$= 16$ kWh<br>Cost $= 16 \times 0.2748$<br>$\approx \$4.40$<br>The cost of using the clothes dryer is \$4.40 | 2 Marks: Correct answer.<br>1 Mark: Finds the amount of electricity used. |
| 28(e) (i) | <table><tr><td>$t$</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>$h$</td><td>0</td><td>3</td><td>4</td><td>3</td><td>0</td></tr></table> | 1 Mark: Correct answer. |
| 28(e) (ii) |  | 1 Mark: Correct answer. |



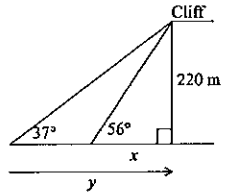


| | | |
|---|---|---|
| 28(e) (iii) | Maximum height reached is 4 metres. | 1 Mark: Correct answer. |
| 28(e) (iv) | Maximum height is reached after 2 seconds. | 1 Mark: Correct answer. |
| 29(a) (i) | Total paid = Loan repayment × Number of repayments<br>$= \$1580.75 \times 20 \times 12$<br>$= \$379\,380$<br>Total amount to be repaid is \$379 380 | 1 Mark: Correct answer. |
| 29(a) (ii) | 30 years:<br>Total paid = Loan repayment × Number of repayments<br>$= \$1364.35\times 30\times 12 = \$491\,166$<br>Extra paid = \$491166 − \$379380<br>$= \$111\,786$ | 1 Mark: Correct answer. |
| 29(b) (i) | $S = V_0(1-r)^n$<br>$= 120000\times(1-0.16)^3 = \$71\,124.48$<br>Value of the truck is \$71 124.85. | 1 Mark: Correct answer. |
| 29(b) (ii) | Loss $= 120000 - 71124.48$<br>$= \$48\,875.52$<br>Percentage Loss $= \frac{48875.52}{120000}\times 100 = 40.7296\% \approx 41\%$ | 1 Mark: Correct answer. |
| 29(c) (i) | $AB$ is parallel to North direction<br>$\angle CAB = 49°$<br>(alternate angles are equal when two lines are parallel)<br>  | 1 Mark: Correct answer. |
| 29(c) (ii) | $a^2 = b^2 + c^2 - 2bc\cos A$<br>$BC^2 = 27^2 + 12^2 - 2\times 27\times 12\times\cos 49°$<br>$BC = 21.16302788\ldots$<br>$\approx 21.2$ km<br>The distance from point $B$ to point $C$ is 21.2 km | 2 Marks: Correct answer.<br>1 Mark: Uses the cosine rule with at least one correct value. |
| 29(c) (iii) | Use the sine rule to find $\angle ACB$<br>$\frac{\sin\angle ACB}{12} = \frac{\sin 49°}{21.163\ldots}$<br>$\sin\angle ACB = \frac{12\sin 49°}{21.163\ldots}$<br>$\angle ACB = 25.3369224\ldots \approx 25°$<br>Bearing of point $B$ from point $C$ is 074°T (49° + 25°) | 2 Marks: Correct answer.<br>1 Mark: Uses the sine rule with at least one correct value. |
| 29(d) (i) | Initial length is 5 cm | 1 Mark: Correct answer. |

| | | |
|---|---|---|
| 29(d) (ii) | $m=\frac{\text{Vertical rise}}{\text{Horizontal run}}=\frac{42}{7}=6$ | 1 Mark: Correct answer. |
| 29(d) (iii) | Equation of the line $y=mx+b$<br>$l=6t+5$ | 1 Mark: Correct answer. |
| 29(e) (i) | Water usage $=35+32+22+16$<br>$=105$ L | 1 Mark: Correct answer. |
| 29(e) (ii) | Yearly water usage $=105\times365$<br>$=38\,325$ L | 1 Mark: Correct answer. |
| 29(e) (iii) | Percentage $=\frac{22}{105}\times100$<br>$=20.95238\ldots$<br>$\approx21\%$ | 1 Mark: Correct answer. |
| 30(a) | Financial expectation = Sum[P(E)×Financial outcome]<br>$\$0=(\frac{1}{100}\times500)+(\frac{5}{100}\times50)+(\frac{1}{100}\times x)+(\frac{100}{100}\times-10)$<br>$\$0=5+2.5+0.01x-10$<br>$0.01x=2.5$<br>$x=\$250$<br>Mystery prize is \$250<br>Alternatively $(\$10\times100)-(\$500\times1)-(\$50\times5)=\$250$ | 2 Marks: Correct answer.<br>1 Mark: Makes some progress towards the solution. |
| 30(b) (i) | Longitude difference $=153-28$<br>$=125^\circ$<br>Time difference = 125 × 4<br>= 500 min<br>= 8 h 20 min | 2 Marks: Correct answer.<br>1 Mark: Finds the longitude difference. |
| 30(b) (ii) | Pretoria 28° E — Noosa 153° E<br>West — East +<br>Time Pretoria = 2 pm − 8 h 20 min<br>= 5.40 am | 1 Mark: Correct answer. |
| 30(c) | $\frac{36}{p}=\frac{10}{25}$<br>$10p=900$<br>$p=90$<br>Toad population is approximately 90. | 2 Marks: Correct answer.<br>1 mark: Uses the capture-recapture method with two correct values. |





| | | |
|---|---|---|
| 30(d) | $z=\frac{x-\bar{x}}{s}$ Percentage $=50\%+\frac{68\%}{2}$<br>$=\frac{70-56}{14}=1$ $=84\%$<br>84% of scores have a $z$-score less that 1 | 2 Marks: Correct answer.<br>1 mark: Calculates the $z$-score. |
| 30(e) (i) | $V=\pi r^2h$<br>$=\pi\times1.4^2\times1.9$<br>$=11.69929104\ldots$ m$^3$<br>$\approx11.699$ m$^3$ | 1 Mark: Correct answer. |
| 30(e) (ii) | Capacity $=11.699\times1000$ L<br>$=11\,699$ L<br>Capacity of the water tank is 11 699 litres | 1 Mark: Correct answer. |
| 30(f) | $5x-y=20$ (1)<br>$3x-4y=12$ (2)<br>Make $y$ the subject of eqn (1)<br>$-y=20-5x$<br>$y=5x-20$ (3)<br>Substitute eqn (3) into eqn (2)<br>$3x-4(5x-20)=12$<br>$3x-20x+80=12$<br>$-17x=-68$<br>$x=4$<br>Substitute $x=4$ into eqn(3)<br>$y=5\times4-20=0$<br>Solution is $x=4$ and $y=0$ | 2 Marks: Correct answer.<br>1 Mark: Finds the correct value for $x$ or $y$. Alternatively makes some significant progress towards the solution. |
| 30(g) | $\tan37^\circ=\frac{220}{y}$<br>$y=\frac{220}{\tan37^\circ}$<br>$=291.9498608\ldots$<br>$\approx292$ m<br>$\tan56^\circ=\frac{220}{x}$<br>$x=\frac{220}{\tan56^\circ}$<br>$=148.3918737\ldots\approx148$ m<br>Distance $=291.9498608\ldots-148.3918737\ldots$<br>$=143.5579\ldots\approx144$ m |  <br>2 Marks: Correct answer.<br>1 Mark: Shows some understanding of the problem. |