ACE Examinations

Student Name: _____

Practise Paper 2

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 Hannah plays a game in which he has a 20% chance of winning \$50, 50% chance of winning \$10 and a 30% chance of losing \$5. What is Hannah's financial expectation when playing this game?

(A) \$10.00
(B) \$13.50
(C) \$16.50
(D) \$55.00

2 Harry uses a 1.5 kilowatt per hour dishwasher for a total of 4 hours. He is charged at a rate of 25.72 cents per kilowatt. What is the cost of using the dishwasher?

(A) \$0.32
(B) \$1.03
(C) \$1.54
(D) \$6.00

3 The ages of the retirees who live in Adam's Retirement Village are: 72, 70, 68, 67, 67, 65, 64 and 60. A retiree has moved into the village who is aged 71. What will be the effect on the ages?

(A) Mean increases and the sample standard deviation increases.
(B) Mean increases and the sample standard deviation decreases.
(C) Mean decreases and the sample standard deviation increases.
(D) Mean decreases and the sample standard deviation decreases.

4 Jordan buys a car for \$19 500 and is depreciated at a rate of 15% of its purchase price each year. What is the salvage value of the car after five years?

(A) \$4 875
(B) \$8 652
(C) \$14 625
(D) \$16 575

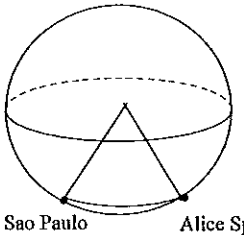
5 The monthly repayments per $1000 on a bank home loan are shown in table below.

Term	8.00%	8.25%	8.50%
20 years	$8.36	$8.52	$8.68
25 years	$7.72	$7.88	$8.05

What is the monthly repayment for a loan of $320 000 at 8.25% p.a. interest rate for 25 years?

(A) $252.16
(B) $272.64
(C) $2521.60
(D) $2726.40

6 The time in Alice Springs is based on the 134°E meridian and that for Sao Paulo 47°W meridian. At 4.00 pm on a Sunday in Alice Springs Christopher decided to ring a friend in Sao Paulo. What day and time is it in Sao Paulo?



Sao Paulo 24° S 47°W

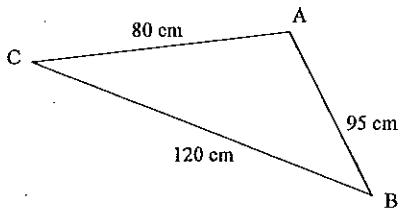
Alice Springs 24° S 134° E

(A) 3.56 am
(B) 4.04 am
(C) 8.57 am
(D) 11.03 pm

7 The stopping distance (d) of a scooter travelling at a speed of s metres per second is given by the formula $d = \frac{1}{4}(s^2 + s + 2)$. What is the stopping distance given a speed of 8 metres per second?

(A) 4.5 m
(B) 18.5 m
(C) 20.0 m
(D) 74.0 m

8 Find $\angle BAC$, to the nearest degree.



(A) 40
(B) 42
(C) 52
(D) 86

9 Isaac scored 81 in an assessment task. The mean for this task was 67 with a standard deviation of 7.0. What is Isaac's z-score?

(A) –2
(B) –1
(C) 1
(D) 2

10 What is the amount of interest that Carlee will pay for a loan of $2 000 over a term of 18 months?

Monthly repayment			
Term of loan	Amount of loan		
	$2 000	$6 000	$10 000
6 months	$353	$570	$899
12 months	$186	$380	$599
18 months	$141	$289	$452
24 months	$102	$251	$372
30 months	$91	$282	$344

(A) $538
(B) $1202
(C) $2538
(D) $3202

11 There are six cards, each labelled with a different number from 1 to 6. Two cards are to be drawn at random without replacement. What is the probability of drawing 65?

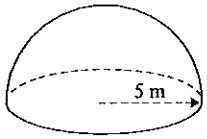
(A) $\frac{1}{36}$

(B) $\frac{1}{30}$

(C) $\frac{1}{15}$

(D) $\frac{1}{12}$

12 Calculate the surface area of a closed hemisphere with a radius of 5 m. Answer in square metres correct to the nearest whole number.



(A) 79 m^2

(B) 236 m^2

(C) 314 m^2

(D) 393 m^2

13 What is the best description between living standards and life expectancy?

(A) Zero correlation.

(B) Constant correlation

(C) Negative correlation.

(D) Positive correlation.

14 Which is the correct expression to make v the subject of the formula $u = pq + vt^2$?

(A) $v = \frac{t^2}{u + pq}$

(B) $v = \frac{t^2}{u - pq}$

(C) $v = \frac{u + pq}{t^2}$

(D) $v = \frac{u - pq}{t^2}$

15 How many kilobits per second are there in 8 000 megabits per second?

(A) 0.008

(B) 8

(C) 8 000 000

(D) 8 000 000 000

16 What is the angular distance (angle at the centre) between Boston (42°N, 71°W) and Santiago (33°S, 71°W)?

(A) 0°

(B) 9°

(C) 71°

(D) 75°

17 Eva is concerned about the caterpillar population in the local community. She collects 240 caterpillars and tags them. A couple of months later she collects 25 caterpillars and found 10 of them were tagged. What is her estimate of the caterpillar population using the capture-recapture method?

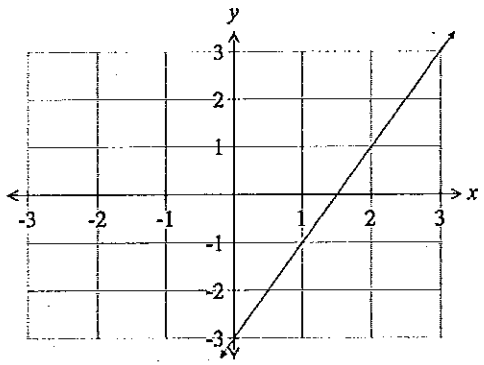
(A) 96

(B) 336

(C) 576

(D) 600

18



The correct equation of line shown below is:

(A) $y = 2x - 3$

(B) $y = -2x - 3$

(C) $y = \frac{1}{2}x - 3$

(D) $y = -\frac{1}{2}x - 3$

19 Tahlia borrows $320 000 over 24 years at a reducible interest rate of 5.9% p.a. She pays $2130 per month. What is the total paid on this loan?

(A) $293 440

(B) $453 120

(C) $613 440

(D) $773 120

20 Three cards (Ace, Two and Three) are placed face down on a table. One card is selected at random and replaced. A second card is then selected at random. This experiment is repeated 36 times. What is expected number of double aces?

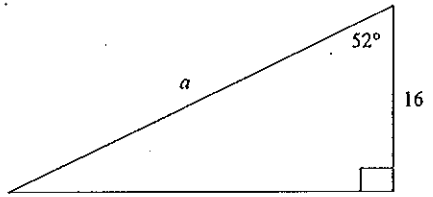
(A) 1

(B) 4

(C) 6

(D) 8

21 What is the value of a in the triangle below?



(A) $\dfrac{16}{\cos 52^\circ}$

(B) $\dfrac{16}{\sin 52^\circ}$

(C) $16\times\cos 52^\circ$

(D) $16\times\sin 52^\circ$

22 What is the solution to the following pair of simultaneous equations?

$$3x-5y=28$$

$$x+4y=15$$

(A) (11, 1)

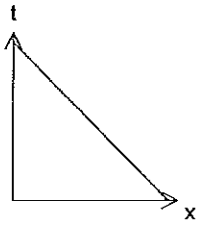
(B) (1, 11)

(C) (6, −2)

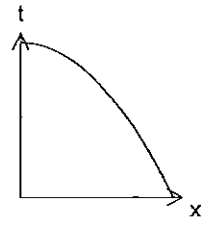
(D) (−2, 6)

23 The time (t) taken to write a report varies inversely with the number (x) of people writing the report. Which graph best represents this relationship?

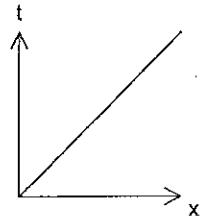
(A)



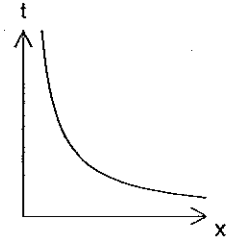
(B)



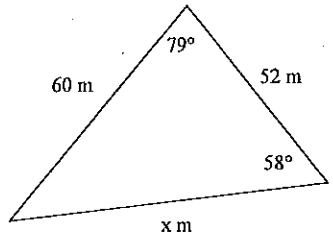
(C)



(D)



24 The correct value for x is



(A) $x=\dfrac{60\sin 58^\circ}{\sin 43^\circ}$

(B) $x=\dfrac{60\sin 79^\circ}{\sin 58^\circ}$

(C) $x=\dfrac{60\sin 79^\circ}{\sin 43^\circ}$

(D) $x=\dfrac{52\sin 79^\circ}{\sin 58^\circ}$

25 A credit card has a daily interest rate of 0.06% per day (no interest free period). Find the interest charged on $1700 for 15 days. Answer correct to the nearest cent.

(A) $1.02

(B) $15.36

(C) $102.00

(D) $4074.15

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) Mitch surveyed his class and summarised the results in the following table.

	Play football	Do not play football	Total
Weight > 70 kg	10	8	18
Weight < 70 kg	5	9	14
	15	17	32

(i) What percentage of his class has weight less than 70 kg and play football? 1

(ii) What is the fraction of students in his class who play football? 1

(iii) One person was selected at random from his class who does not play football. What is the probability that this person is less than 70 kg? 1

(iv) What is the probability that a student selected at random from his class is greater than 70 kg? 1

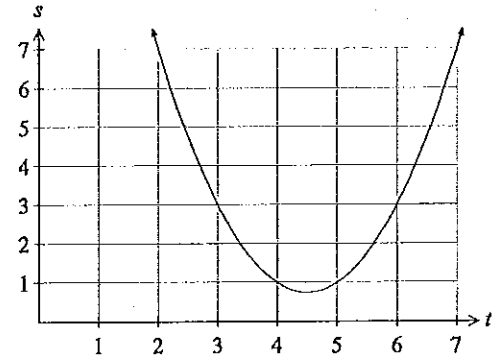
(b) The time taken (in seconds) to download ten different videos is shown below: 130, 145, 120, 153, 143, 127, 129, 142, 137, 148, 139, 141.

Calculate correct to 2 decimal places.

(i) Mean 1

(ii) Median 1

(c) The relationship between speed (s) and time (t) for a motor vehicle is modelled by the formula: $s = t^2 - 9t + 21$



(i) What is the speed when time is 2.5? 1

(ii) What time achieves the lowest speed? 1

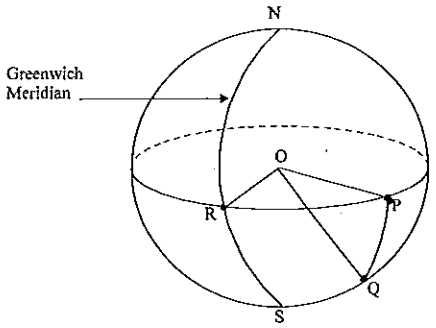
(iii) Determine the time required to achieve a speed of 3. 1

(d) A home loan of $400 000 is given to Patricia. The loan is to be repaid 300 equal monthly instalments at 8% p.a. compounded monthly.

(i) Determine the amount to be repaid on this loan. 1

(ii) How much interest is paid on this loan. 1

(e) In the diagram of the earth, O represents the centre and the points P and R lie on the equator. Point R is on the Greenwich meridian. The angles POR and POQ are 58° and 53° respectively.



(i) What are the coordinates of point P? 1

(ii) What are the coordinates of point Q? 1

(iii) Calculate the distance between points P and R to the nearest kilometre. 1

(iv) Calculate the distance between points P and Q to the nearest kilometre. 1

Question 27 (15 marks) **Marks**

(a) Sally's recent results in hospitality and timber are recorded in the table

Course	Class Mean	Class Standard Deviation	Sally's Result
Hospitality	55	10	85
Timber	55	15	85

(i) What is Sally's z-score for timber? 1

(ii) Explain the z-score in timber in terms of the class mean and class standard deviation. 1

(iii) What hospitality mark would be equivalent to a z-score of -1? 1

(b) The digits 8, 7, 6, 5, 4 and 3 are written on six separate cards. Three cards are drawn at random from the deck, one at a time, and placed face up on a table to form a three-digit number.

(i) How many different three-digit numbers can be formed? 1

(ii) What is the probability of selecting 345? 1

(iii) What is the probability of selecting a number greater than 600? 1

(iv) What is the probability of selecting an even number or the number 345? 1

(c) The table below shows a two mobile phone plans.
Anthony uses Plan A. Eric uses Plan B.

		Plan A	Plan B
Monthly Access Fee		$22.00	$39.00
Free calls		$50.00	$20.00
Connection fee - Flagfall		$0.35	$0.25
Call Rates (per 30 sec)		$0.45	$0.39
Messaging	SMS	$0.23	$0.23
	MMS	$0.40	$0.40

(i) What is the charge if Anthony makes 2 minute call? 1

(ii) What is the charge if Eric makes 5 minute call? 1

(iii) Eric makes 100 calls in a month with each call lasting 1 minute. What is the cost on Plan B? 1

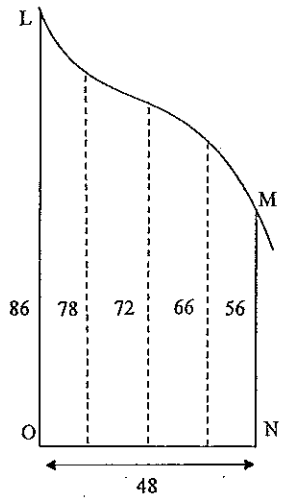
(d) Solve the following equations:

(i) $7x+2=17+4x$ 1

(ii) $2a=1+\frac{4a}{3}$ 1

(iii) $\sqrt{4z-8}=2$ 1

(e) Use Simpson's rule twice to estimate the area of *LMNO*. 2



Question 28 (15 marks) **Marks**

(a) The time taken T for the length of rope R to be rotated about a central point is given by the formula $T = \sqrt{\frac{9R}{2.5}}$.

(i) Make R the subject of the formula. **1**

(ii) What is the length of rope if it takes 9 seconds for a single revolution? **1**

(iii) What is the time taken for a rope of length 20 to complete a revolution? Answer correct to two decimal places. **1**

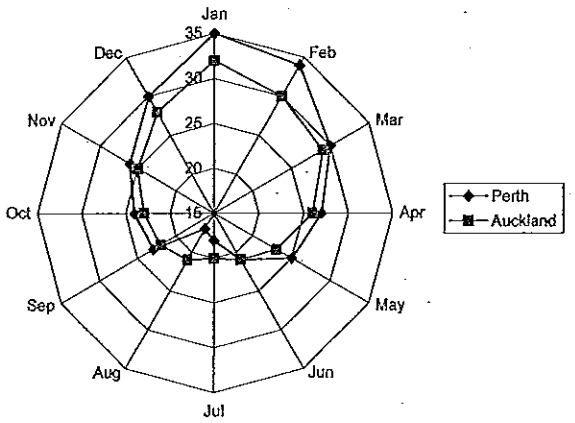
(b) An aircraft leaves the Pretoria 26°S, 28°E and travels due east to Caloundra 26°S, 153°E.

(i) What is the latitude of Pretoria? **1**

(ii) What is the distance the aircraft travels between Pretoria and Caloundra? Answer to the nearest kilometre. **1**

(iii) The aircraft took 35 hours to reach Caloundra. What was the average speed of the plane to the nearest kilometre per hour? **1**

(c) The radar chart compares the average temperature of two cities.



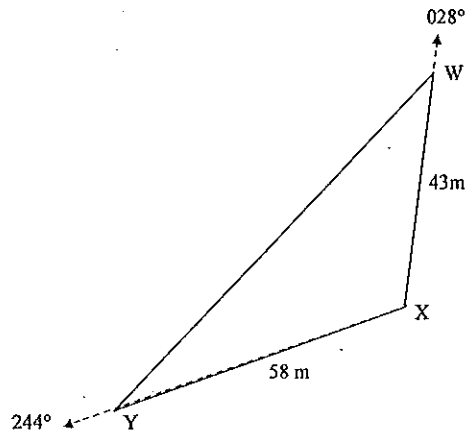
(i) What the average temperature for Perth in January? **1**

(ii) Which month has the lowest average temperature for Auckland? **1**

(iii) Which months is the temperature for Auckland greater than Perth? **1**

(iv) Calculate the range of average temperatures for Perth? **1**

(d) XYZ represents a triangular area of land. The bearing of W from X is 028° and the bearing of Y from X is 244°. The distance XY is 58 m and the distance XW is 43 m



(i) Find the angle WXY. **1**

(ii) Calculate the area of the land to the nearest square metre. **1**

(iii) What is the length of WY correct to one decimal place? **1**

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

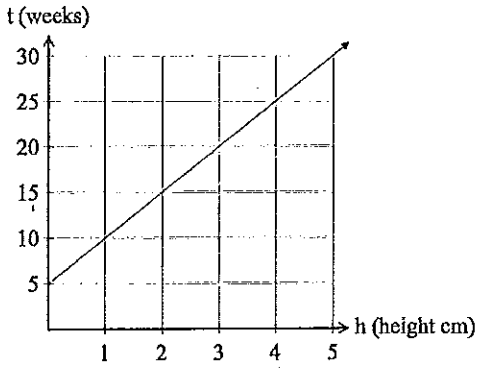
Water usage	L/day
Washing machine	40
Toilet	28
Dishwasher	22
Other	15

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

(ii) What percentage of her water usage is for the dishwasher? Answer to the nearest whole number. **1**

Question 29 (15 marks) **Marks**

(a) Stefan drew a graph of the height of a flowering shrub over thirty weeks.



(i) When was the initial height of the shrub? 1

(ii) Calculate the gradient of the line. 1

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

(b) Three cards numbered five, six and seven are placed face down on a table. One card is selected at random and replaced. A second card is then selected at random. This experiment is repeated 360 times

(i) What is the probability of selecting two six's? 1

(ii) How many double six's would be expected? 1

(iii) What is the probability of one of the cards being a seven? 1

(iv) How many single sevens would be expected? 1

(c) A truck was purchased for \$21 500 and sold for \$8500 after 5 years. Assume straight-line depreciation

(i) How much does the truck depreciate each year? 1

(ii) Construct a depreciation table for the first five years. 1

(d) Alan borrowed \$310 000 at 7.9% p.a. reducible interest. The interest is charged monthly and the monthly repayment is \$2370. The table shows the amounts owing during the first three months

Months	Principal	Interest	$P+I$	$P+I-R$
1	\$310 000.00	\$2040.83	\$312 040.83	\$309 670.83
2		\$2038.67	\$311 709.50	
3	\$309 339.50			

(i) What is the principal at the beginning of the second month? 1

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

(iii) Calculate the interest to be paid at the beginning of the third month? 1

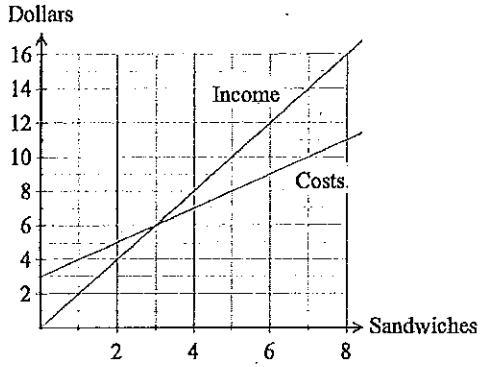
(iv) How much is owed at the end of the third month? 1

(e) Find the least-squares line of best fit given the following data: 2

$\bar{x}=15.679, \bar{y}=85.128, s_x=12.786, s_y=5.985, r=0.865$

Question 30 (15 marks) **Marks**

(a) The linear graphs below show the cost of making a sandwich and the income received from selling the sandwiches.



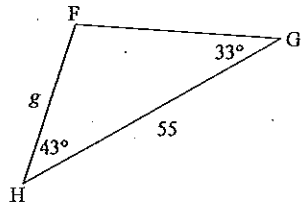
(i) Let the income received be \$$I$ and n the number of sandwiches sold. Write a formula for the income. 1

(ii) Let the costs of making a sandwich be \$$C$ and n the number of sandwiches sold. Write a formula for the costs. 1

(iii) What is the profit if 7 sandwiches are sold? 1

(iv) How many sandwiches are needed to be sold to break-even? 1

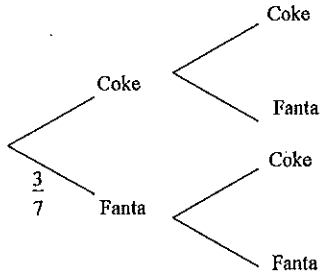
(b) ΔFGH has $\angle FGH = 33°$ and $\angle GHF = 43°$. The length of GH is 55.



(i) What is the size of angle F? 1

(ii) What is the value of g, correct to one decimal place? 2

(c) A shopping bag contains 4 bottles of coke and 3 bottles of fanta. Two bottles are selected at random, without replacement. A tree diagram is shown below.



(i) Insert the probabilities on all branches. 1

(ii) Determine the probability that both bottles are coke? 1

(iii) What is the probability of selecting different bottles? 1

(d) The table below shows the weight of four people.

Name	Mia	Noah	Olive	Pat
Weight (kg)	70.6	71.2	69.9	70.7

(i) Calculate the population mean and population standard deviation. Answer correct to one decimal place. 1

(ii) A sample of three people is chosen at random. How many samples are possible? 1

(iii) List all the possible samples. 1

(e) What is the centre angle of a sector with an area of 13.68 m^2 and radius of 3.50 m? Answer correct to the nearest degree. 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
- θ 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
- θ 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

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

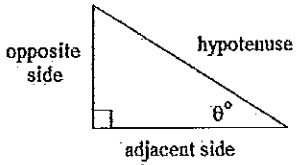
- h distance between successive measurements
- d_f is first measurement
- d_m is middle measurement
- d_l is last measurement

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 ΔABC

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

Cosine rule

In ΔABC

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

or

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

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:

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

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

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 Practise Paper 2

HSC Mathematics General 2 Yearly Examination

Worked solutions and marking guidelines

Section 1		
	Solution	**Criteria**
1	Financial expect $= (\frac{20}{100}\times\$50)+(\frac{50}{100}\times\$10)-(\frac{30}{100}\times\$5)$ $=\$10+\$5-\$1.5$ $=\$13.50$	1 Mark: B
2	Electricity $=1.5\times4$ Cost $=6\times0.2572$ $=6$ kWh $\approx\$1.54$	1 Mark: C
3	$\bar{x}=66.63$ to 67.11 $\sigma=3.70$ to 3.76 Mean increases and sample standard deviation increases	1 Mark: A
4	$S=V_0 - Dn$ $=19500-(0.15\times19500)\times5=\$4875$	1 Mark: A
5	Repayment $=7.88\times320$ $=\$2521.60$	1 Mark: C
6	Longitude difference $=134^\circ+47^\circ=181^\circ$ Time difference $=181\times4$ $=724$ minutes or 12 hours 4 minutes Sao Paulo is west of Alice Springs (subtract time) Sao Paulo's time = 4.00 pm − 12h 4m = 3.56 am	1 Mark: A
7	$d=\frac{1}{4}(s^2+s+2)$ $=\frac{1}{4}(8^2+8+2)$ $=18.5$ m	1 Mark: B
8	$\cos\angle BAC=\frac{(80^2+95^2-120^2)}{(2\times80\times95)}$ $=0.067434210$ $\angle BAC=86^\circ$	1 Mark: D
9	$z=\frac{x-\bar{x}}{s}$ $=\frac{81-67}{7}$ $=2$	1 Mark: D

10	$I=(141\times18)-2000$ $=\$538$	1 Mark: A
11	Number of selections $=6\times5=30$ P(65) $=\frac{1}{30}$	1 Mark: B
12	$SA=\frac{1}{2}(4\pi r^2)+\pi r^2$ $=3\times\pi\times5^2$ $=236$ m^2	1 Mark: B
13	A rise in the living standards results in a rise in life expectancy. Positive correlation.	1 Mark: D
14	$u=pq+vt^2$ $vt^2=u-pq$ $v=\frac{u-pq}{t^2}$	1 Mark: D
15	8000 Mbps $=8000\times1000$ Kbps $=8\ 000\ 000$ Kbps	1 Mark: C
16	Latitude difference $=42^\circ+33^\circ$ $=75^\circ$	1 Mark: D
17	$\frac{240}{p}=\frac{10}{25}$ $10p=6000$ $p=600$ Caterpillar population is approximately 600.	1 Mark: D
18	$m=\frac{\text{Vertical rise}}{\text{Horizontal run}}=\frac{3}{1.5}=2$ $y=mx+b$ $y=2x-3$	1 Mark: A
19	Total paid $=\$2130\times12\times24$ $=\$613\ 440$	1 Mark: C
20	Expected outcomes = P(E) × No. of trials $=\frac{1}{9}\times36=4$	1 Mark: B
21	$\cos52^\circ=\frac{16}{a}$ $a=\frac{16}{\cos52^\circ}$	1 Mark: A

22	$3x-5y=28$ (1) $x+4y=15$ (2) Multiply eqn (2) by 3 $3x+12y=45$ (3) Subtract eqn (1) from eqn (3) $17y=17$ $y=1$ Substitute $y=1$ into eqn (2) $x+4=15$ $x=11$ Solution is $x=11$ and $y=1$ (11,1)	1 Mark: A
23	$t=\frac{k}{x}$ Hyperbolic function.	1 Mark: D
24	$\frac{x}{\sin 79^\circ}=\frac{60}{\sin 58^\circ}$ $x=\frac{60\times\sin 79^\circ}{\sin 58^\circ}$	1 Mark: B
25	$A=P(1+r)^n$ $=\$1700\times(1+0.0006)^{15}$ $=\$1715.364427\ldots$ Interest charged $=\$1715.36-\$1700$ $=\$15.36$	1 Mark: B

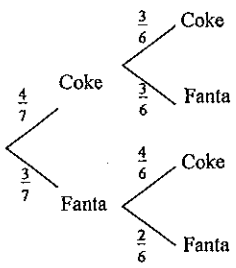
Section II		
	Solution	**Criteria**
26(a) (i)	Percentage $=\frac{5}{32}\times 100$ $=15.625\%$	1 Mark: Correct answer.
26(a) (ii)	Fraction $=\frac{15}{32}$	1 Mark: Correct answer.
26(a) (iii)	P(E) $=\frac{9}{17}$	1 Mark: Correct answer.
26(a) (iv)	P(E) $=\frac{18}{32}=\frac{9}{16}$	1 Mark: Correct answer.
26(b) (i)	$\bar{x}=\frac{\sum x}{n}=\frac{1654}{12}=137.833333\approx 137.83$	1 Mark: Correct answer.
26(b) (ii)	120, 127, 129, 130, 137, 139, 141, 142, 143, 145, 148, 153 Median is 140.	1 Mark: Correct answer.
26(c) (i)	From the graph about 5 $s=t^2-9t+21$ $=2.5^2-9\times 2.5+21=4.75$	1 Mark: Correct answer.
26(c) (ii)	From the graph about 4.5	1 Mark: Correct answer.
26(c) (iii)	From the graph $t=3$ or $t=6$	1 Mark: Correct answer.
26(d) (i)	$A=P(1+r)^n$ $=400000\left(1+\frac{0.08}{12}\right)^{300}=\$2\ 936\ 070.39$	1 Mark: Correct answer.
26(d) (ii)	$I=A-P$ $=\$2\ 936\ 070.39-\$400\ 000$ $=\$2536070.39$	1 Mark: Correct answer.
26(e) (i)	Point P has the coordinates 0°, 58°E.	1 Mark: Correct answer.
26(e) (ii)	Point Q has the coordinates 53°S, 58°E.	1 Mark: Correct answer.
26(e) (iii)	P and R are on the equator Longitude difference $=58-0=58$ Distance $=\frac{58}{360}\times 2\times\pi\times 6400$ $=6478.662183\approx 6479$ km	1 Mark: Correct answer.

26(e) (iv)	Latitude difference $= 53^\circ - 0 = 53^\circ$ $\text{Distance} = \frac{53}{360} \times 2 \times \pi \times 6400$ $= 5920.156823$ ≈ 5920 km	1 Mark: Correct answer.
27(a) (i)	$z = \frac{x - \bar{x}}{s}$ $= \frac{85 - 55}{15} = 2$	1 Mark: Correct answer.
27(a) (ii)	Sally has a z-score of 2 which is two standard deviations above the mean.	1 Mark: Correct answer.
27(a) (iii)	$z = \frac{x - \bar{x}}{s}$ $-1 = \frac{x - 55}{10}$ $x = (-1 \times 10) + 55 = 45$	1 Mark: Correct answer.
27(b) (i)	Number of outcomes $= 6 \times 5 \times 4$ $= 120$	1 Mark: Correct answer.
27(b) (ii)	$\text{P}(345) = \frac{1}{120}$	1 Mark: Correct answer.
27(b) (iii)	$\text{P}(>600) = \frac{2}{6} = \frac{1}{3}$	1 Mark: Correct answer.
27(b) (iv)	$\text{P(even or 345)} = \frac{3}{6} + \frac{1}{120} = \frac{61}{120}$	1 Mark: Correct answer.
27(c) (i)	Charge $= 0.35 + (120 \div 30) \times 0.45$ $= \$2.15$	1 Mark: Correct answer.
27(c) (ii)	Charge $= 0.25 + (300 \div 30) \times 0.39$ $= \$4.15$	1 Mark: Correct answer.
27(c) (iii)	Charge $= 100 \times [0.25 + (60 \div 30) \times 0.39]$ $= \$103.00$ Cost $= 103 + 39 - 20$ $= \$122$ Cost of plan B is \$122	1 Mark: Correct answer.
27(d) (i)	$7x + 2 = 17 + 4x$ $3x = 15$ $x = 5$	1 Mark: Correct answer.

27(d) (ii)	$2a = 1 + \frac{4a}{3}$ $6a = 3 + 4a$ $2a = 3$ $a = \frac{3}{2}$ or $1\frac{1}{2}$	1 Mark: Correct answer.
27(d) (iii)	$\sqrt{4z - 8} = 2$ $4z - 8 = 4$ $4z = 12$ $z = 3$	1 Mark: Correct answer.
27(e)	$A = \frac{h}{3}(d_f + 4d_m + d_l) + \frac{h}{3}(d_f + 4d_m + d_l)$ $= \frac{12}{3}(86 + 4 \times 78 + 72) + \frac{12}{3}(72 + 4 \times 66 + 56)$ $= 3448$ sq units	2 Marks: Correct answer. 1 Mark: Uses Simpson's with one correct value
28(a) (i)	$T = \sqrt{\frac{9R}{2.5}}$ $T^2 = \frac{9R}{2.5}$ $R = \frac{2.5T^2}{9}$	1 Mark: Correct answer.
28(a) (ii)	$R = \frac{2.5T^2}{9}$ $= \frac{2.5 \times 9^2}{9}$ $= 22.5$	1 Mark: Correct answer.
28(a) (iii)	$T = \sqrt{\frac{9R}{2.5}}$ $= \sqrt{\frac{9 \times 20}{2.5}}$ $= 8.49$	1 Mark: Correct answer.
28(b) (i)	The latitude of Pretoria is 26°S.	1 Mark: Correct answer.
28(b) (ii)	Longitude difference $= 153^\circ - 28^\circ = 125^\circ$ $l = \frac{\theta}{360} \times 2\pi r$ $= \frac{125}{360} \times 2 \times \pi \times 6400$ $= 13963$ km	1 Mark: Correct answer.

28(b) (iii)	Average speed $= \dfrac{\text{Distance}}{\text{Time}}$ $= \dfrac{13963}{35}$ $= 399$ km/h	1 Mark: Correct answer.
28(c) (i)	35° (from the graph)	1 Mark: Correct answer.
28(c) (ii)	July has the lowest temperature for Auckland	1 Mark: Correct answer.
28(c) (iii)	The temperature for Auckland is greater than Perth in the months of August and July.	1 Mark: Correct answer.
28(c) (iv)	Range $= 35 - 17 = 18°$	1 Mark: Correct answer.
28(d) (i)	$\angle XYW = 360° - (244° - 28°)$ $= 144°$	1 Mark: Correct answer.
28(d) (ii)	$A = \dfrac{1}{2}ab\sin C$ $= \dfrac{1}{2} \times 43 \times 58 \times \sin 144° = 733 \text{ m}^2$	1 Mark: Correct answer.
28(d) (iii)	$a^2 = b^2 + c^2 - 2bc\cos A$ $WY^2 = 58^2 + 43^2 - 2 \times 58 \times 43 \times \cos 144°$ $WY = 96.2$ m	1 Mark: Correct answer.
28(e) (i)	Water usage $= 40 + 28 + 22 + 15$ $= 105$ L	1 Mark: Correct answer.
28(e) (ii)	Percentage $= \dfrac{22}{105} \times 100$ $= 20.95238\ldots \approx 21\%$	1 Mark: Correct answer.
29(a) (i)	Initial height is 5 cm	1 Mark: Correct answer.
29(a) (ii)	$m = \dfrac{\text{Vertical rise}}{\text{Horizontal run}} = \dfrac{25}{5} = 5$	1 Mark: Correct answer.
29(a) (iii)	Equation of the line $y = mx + b$ $h = 5t + 5$	1 Mark: Correct answer.
29(b) (i)	P(66) $= \dfrac{1}{3} \times \dfrac{1}{3} = \dfrac{1}{9}$	1 Mark: Correct answer.
29(b) (ii)	Expected outcomes = P(E) × Number of trials $= \dfrac{1}{9} \times 360 = 40$	1 Mark: Correct answer.
29(b) (iii)	P(57, 67, 76, 75) $= \dfrac{4}{9}$	1 Mark: Correct answer.

29(b) (iv)	Expected outcomes = P(E) × Number of trials $= \dfrac{4}{9} \times 360 = 160$	1 Mark: Correct answer.
29(c) (i)	$S = V_0 - Dn$ $\$8500 = \$21500 - D \times 5$ $D = \dfrac{\$21500 - \$8500}{5} = \$2600$	1 Mark: Correct answer.
29(c) (ii)	<table><tr><th>Year</th><th>Value</th><th>Dep</th><th>Dep Value</th></tr><tr><td>1</td><td>\$21500</td><td>\$2600</td><td>\$18900</td></tr><tr><td>2</td><td>\$18900</td><td>\$2600</td><td>\$16300</td></tr><tr><td>3</td><td>\$16300</td><td>\$2600</td><td>\$13700</td></tr><tr><td>4</td><td>\$13700</td><td>\$2600</td><td>\$11100</td></tr><tr><td>5</td><td>\$11100</td><td>\$2600</td><td>\$8500</td></tr></table>	1 Mark: Correct answer.
29(d) (i)	$P = \$309\ 670.83$	1 Mark: Correct answer.
29(d) (ii)	$P = \$309670.83 + \$2038.67 - \$2370$ $= \$309\ 339.50$	1 Mark: Correct answer.
29(d) (iii)	$I = \dfrac{0.079}{12} \times \$309339.50$ $= \$2036.49$	1 Mark: Correct answer.
29(d) (iv)	$P = \$309339.50 + \$2036.49 - \$2370$ $= \$309\ 005.99$	1 Mark: Correct answer.
29(e)	$m = r\dfrac{s_y}{s_x} = 0.865 \times \dfrac{5.985}{12.786} = 0.40489\ldots \approx 0.405$ $b = \bar{y} - m\bar{x} = 85.128 - 0.405 \times 15.679 \approx 78.778$ $y = mx + b$ $= 0.405x + 78.778$	2 Marks: Correct answer. 1 Mark: Shows some understanding of the problem.
30(a) (i)	$m = \dfrac{\text{Vertical rise}}{\text{Horizontal run}} = \dfrac{12}{6} = 2,\ b = 0$ Equation of income $y = mx + b$ $I = 2n$	1 Mark: Correct answer.
30(a) (ii)	$m = \dfrac{\text{Vertical rise}}{\text{Horizontal run}} = \dfrac{7}{7} = 1,\ b = 3$ Equation of costs $y = mx + b$ $C = 1n + 3$	1 Mark: Correct answer.
30(a) (iii)	Profit $= (2 \times 7) - (1 \times 7 + 3)$ $= 4$	1 Mark: Correct answer.
30(a) (iv)	$n = 3$ (Point of intersect on the graph)	1 Mark: Correct answer.

30(b) (i)	$\angle HFG + 43^\circ + 33^\circ = 180^\circ$ $\angle HFG = 104^\circ$	1 Mark: Correct answer.
30(b) (ii)	$\frac{g}{\sin \angle FGH} = \frac{f}{\sin \angle HFG}$ $\frac{g}{\sin 33^\circ} = \frac{55}{\sin 104^\circ}$ $g = \frac{55 \times \sin 33^\circ}{\sin 104^\circ} = 30.9$	2 Marks: Correct answer. 1 Mark: Uses sine rule with one correct value.
30(c) (i)		1 Mark: Correct answer.
30(c) (ii)	$P(CC) = \frac{4}{7} \times \frac{3}{6}$ $= \frac{12}{42} = \frac{2}{7}$	1 Mark: Correct answer.
30(c) (iii)	$P(CF \text{ or } FC) = \frac{4}{7} \times \frac{3}{6} + \frac{3}{7} \times \frac{4}{6}$ $= \frac{24}{42} = \frac{4}{7}$	1 Mark: Correct answer.
30(d) (i)	$\mu = \frac{70.6 + 71.2 + 69.9 + 70.7}{4} = 70.6$ kg $\sigma_n = 0.46368\ldots \approx 0.5$ kg	1 Mark: Correct answer.
30(d) (ii)	Number of samples $= \frac{4 \times 3 \times 2}{3 \times 2 \times 1} = 4$ (or ${}^4C_3 = 4$) There are 4 possible samples.	1 Mark: Correct answer.
30(d) (iii)	Possible samples {MNO, MNP, MOP, NOP}	1 Mark: Correct answer.
30(e)	$A = \frac{\theta}{360} \pi r^2$ $13.68 = \frac{\theta}{360} \times \pi \times 3.50^2$ $\theta = \frac{13.68 \times 360}{\pi \times 3.50^2}$ $\approx 128^\circ$	2 Marks: Correct answer. 1 Mark: Shows some understanding of the problem.