▦ ACE Examinations

Student Name: _____

Practise Paper 1
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

1 Sam has 32 GB of data storage on a USB drive? How many data files of average size 6.4 MB can he store?

(A) 5

(B) 204.8

(C) 5000

(D) 5120

2 The table shows the amount Victoria spent on food items in one week. She would like to display this information as a sector graph. What size angle is needed to represent meat and fish?

| Food	Amount
Groceries	$100
Fruit and vegetables	$24
Meat and fish	$36
Milk and dairy	$20

(A) 10°

(B) 18°

(C) 36°

(D) 72°

3 Which expression is equivalent to $2y^2(y+4)-y^2$?

(A) $2y^3 - y^2 + 4$

(B) $2y^3 + 7y^2$

(C) $y^3 + 4y^2$

(D) $8y^3 - y^2$

4 Indiana works part-time and earns $16.50 per hour. If she works from 6.00 pm to midnight she is paid time-and-a-half. Last week Indiana worked 15 hours normal pay and 4 hours at time-and-a-half. What is her gross pay for last week?
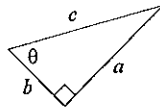
(A) $245.50

(B) $313.50

(C) $346.50

(D) $470.25

5   A developing country compared body mass to income. The correlation coefficient for these quantities was +0.5. Which scatterplot could represent the result?

(A)

(B)

(C)

(D)
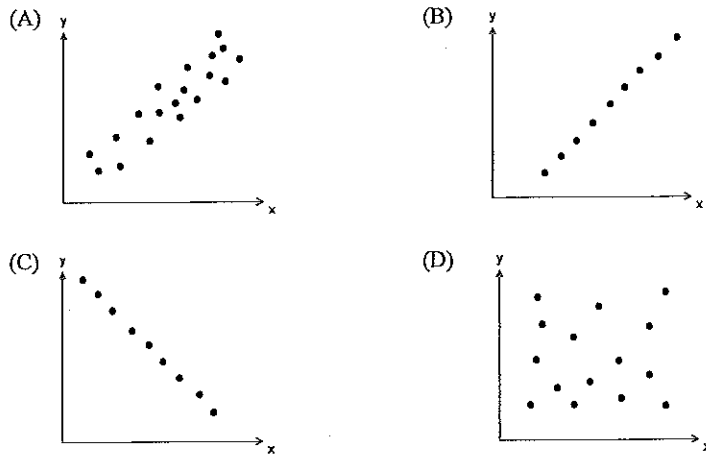
6   What is the value of $\cos\theta$ in the triangle below?

(A) $\dfrac{a}{b}$

(B) $\dfrac{a}{c}$

(C) $\dfrac{b}{a}$

(D) $\dfrac{b}{c}$

7   The scale on an aerial photograph is given as 1 mm = 180 m. If the length of land is 240 m, what is the map length between these points?

(A)   1.33 mm

(B)   2.67 mm

(C)   3.2 mm

(D)   60 mm

8   In a normally distributed set of scores, the mean is 60 and the standard deviation is 8. Approximately what percentage of the scores will lie between 44 and 76?

(A)   34%

(B)   68%

(C)   95%

(D)   99.7%

9   Cameron earns $38 500 in a year. His allowable deductions total $2 500. Using the table below, which of the following expressions represents his total tax payable?

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

(A) $3572 + $1000 × 0.325

(B) $3572 + $1500 × 0.325

(C) $0 + $17 800 × 0.19

(D) $0 + $18 200 × 0.19

10   The colour of the each car passing through an intersection was recorded. When analysing this data, which of the following could be found?

(A)   Mean

(B)   Median

(C)   Mode

(D)   Range

11   The ages of residents attending two community meetings is displayed in the double stem-and-leaf plot opposite. What is the difference in the medians between the age of the residents in meeting A and meeting B?

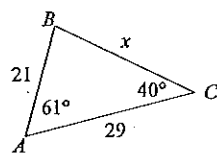| Meeting A		Meeting B
6	0	9
6521	1	337
987521	2	0266899
2100	3	2335

(A)   0

(B)   1

(C)   2

(D)   3

12   Andrew was driving at a speed of 70 km/h and reaction time of 0.50 seconds. What is the stopping distance using the formula $d = \dfrac{5Vt}{18} + \dfrac{V^2}{170}$?

(A)   12 m

(B)   24 m

(C)   39 m

(D)   44 m

13 What is the correct expression for x in triangle ABC?

(A) $x = \dfrac{29\sin 79^\circ}{\sin 61^\circ}$

(B) $x = \dfrac{21\sin 40^\circ}{\sin 61^\circ}$

(C) $x = \dfrac{29\sin 61^\circ}{\sin 79^\circ}$

(D) $x = \dfrac{21\sin 40^\circ}{\sin 79^\circ}$

NOT TO SCALE

14 Olive obtained a personal loan of $30 000. She made a deposit of $2200 and agreed to payments of $820 per month for 4 years. What is the total amount paid for the loan?

(A) $9 360

(B) $11 560

(C) $39 360

(D) $41 560

15 Darcy uses a 2.1-kilowatt per hour clothes dryer for a total of 3.5 hours. He is charged at a rate of 25.1 cents per kilowatt. What is the cost of using the clothes dryer?
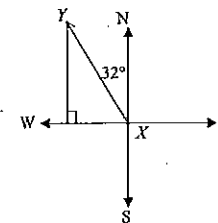
(A) $1.84

(B) $7.35

(C) $29.28

(D) $184.49

16 What is the gradient of a line given the equation $y = 3x - 5$?

(A) $\square 5$

(B) $\square 3$

(C) 3

(D) 5

17 Hayden chooses two cans of soft drink from a refrigerator containing 9 different cans of soft drink. How many different possible choices could Hayden make?

(A) 2

(B) 18

(C) 36

(D) 72

18 The compass bearing of Y from X is N32°W.

NOT TO SCALE

What is the compass bearing of X from Y?

(A) N32°W

(B) N58°E

(C) S32°E

(D) S58°W

19 A mobile phone plan has a monthly charge of $43 on a 24 month contract. The call rate is $0.94 per 60 second block plus there is a $0.25 flagfall. What is the cost of making a five minute call?

(A) $2.19

(B) $4.70

(C) $4.95

(D) $56.65

20 The number of people in a town is given by $N = 1000(2.5^t)$ where N is the number of people and t is the time in years. What is the population after 2 years?
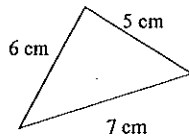
(A) 1581

(B) 2500

(C) 5000

(D) 6250

21 Solve the equation $\sqrt{x} - 16 = 20$.

(A) 2

(B) 6

(C) 16

(D) 1296

22 Tyson's water usage in one day was 60 L shower, 39 L toilet, 33 L tap and 8 L washing machine. What percentage water usage is for the washing machine?

(A) 5.7%

(B) 8.0%

(C) 42.9%

(D) 140%

23 The largest angle in the triangle below is θ.

NOT TO SCALE

What is the value of θ?

(A) 44°

(B) 57°

(C) 78°

(D) 82°

24 Addison is a hospital patient who is given 1.5 litres of fluid over 8 hours. What is the required drip rate in mL/h?

(A) 0.2

(B) 5.3

(C) 12

(D) 187.5

25 Heidi borrows $4 000 for a trip to Hawaii. She repays the loan over 2 years at an interest rate of 8% p.a. compounding monthly. What is Heidi's monthly instalment?

(A) $195.48

(B) $691.55

(C) $1056.96

(D) $23 364.72

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)

(a) The double box-and-whisker plot shows the amount of data uploaded and downloaded by Zara each day for the past month.
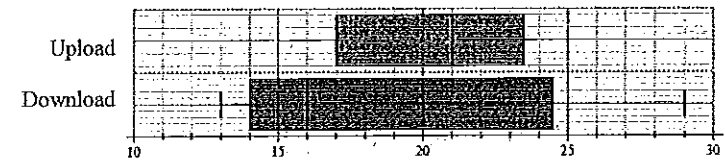
(i) Find the interquartile range for uploading. 1

(ii) What percentage of downloading is the amount of data less than 16? 1

(iii) Nathan said that the graph shows Zara downloads more data than she uploads. Do you agree with Nathan's statement? Give a reason for your answer. 1

(b) Simplify $4a(b+a)-a(b-4a)$ 2

(c) Emily is an optometrist who is works at the local shopping centre. She is paid $78 000 per annum.

(i) How much is her gross fortnightly pay? 1

_____

_____

_____

(ii) Emily has 9% of her gross income paid into a superannuation fund. How much each fortnight is paid into superannuation? 1

_____

_____

_____

(iii) Emily pays PAYG tax of $585 per fortnight and has tax deductions of $8 per week for dry cleaning, $90 for work-related travel and $410 per year for union fees. 1

What is Emily's total allowable tax deduction?

_____

_____

_____

(iv) Calculate Emily's taxable income. 1

_____

_____

_____

(v) Medicare is calculated at 1.5% of the taxable income. How much is Emily's Medicare levy? 1

_____

_____

_____

_____

(d) A cafe offers the following meal choices for burgers:

- Beef, fish or vegetable patty (B, F or V)
- Plain or wholemeal bun (P or W)
- Chips or salad (C or S)

(i) How many choices are possible? 2

_____

_____

_____

_____

(ii) Construct a tree diagram to show the different choices. 2

(iii) What is the probability of choosing a plain beef burger with a salad? 1

_____

_____

_____

_____

Question 27 (15 marks)

(a) Archie borrowed $372 000 at 8% p.a. reducible interest. The interest is charged monthly and the monthly repayment is $2840. The table shows the amounts owing during the first month.

Months (n)	Principal (P)	Interest (I)	P + I	P + I - R
1	$372 000.00	$2480.00	$374 480.00	$371 640.00
2				
3				

(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

(b) Molly is playing a game with three possible results. This is shown in the table below.

	Probability	Financial Outcome
Result A	25%	Win $100
Result B	40%	Win $75
Result C	35%	Lose $125

What is Molly's financial expectation when playing this game?   2

(c) Sophia is 65 kg and has consumed 7 standard drinks in the past five hours. Calculate Sopia's blood alcohol content. (Answer correct to 4 decimal places)   2

(d) Lily is the 4th girl in a family of 4 girls and no boys. She decides to look at the probability of gender in families.

(i) What is the probability of a family of 4 girls and no boys?   1

(ii) What is the probability of a family of 3 girls and then a boy?   1

(iii) What is the probability of a family of 3 girls and a boy born in any position in the family?   2

(e) Find the volume using Simpson's rule and the following set of data: 1

$h = 15$ m, $A_f = 11$ m, $A_m = 18$ m and $A_l = 17$ m.

(f) A fisherman catches 64 bream in a lake and tags them. A couple of months 2
later he catches 332 bream and found 16 of them were tagged. Use the
capture-recapture method to estimate the number of bream in the lake.

Question 28 (15 marks)

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

Present value of $1						
Period	2%	4%	6%	8%	10%	12%
1	0.98	0.96	0.94	0.93	0.91	0.89
2	1.94	1.89	1.83	1.78	1.74	1.69
3	2.88	2.78	2.67	2.58	2.49	2.40
4	3.81	3.63	3.47	3.31	3.17	3.04

(i) What would be the present value of a $6 000 per year annuity at 4% 1
per annum for 2 years, with interest compounding yearly?

(ii) What is the value of an annuity that would provide a present value of 1
$47 988 after 3 years at 8% per annum compound interest?

(iii) An annuity of $1000 each six months is invested at 12% per annum,
compounded biannually for 2 years. What is the present value of the 1
annuity?

(b) The Mathematics General examination paper has 25 multiple choice questions with choices A, B, C or D.

(i) How many possible combinations of answers are there for the 25 questions?　　　　1

_____

_____

(ii) What is the probability of randomly achieving 25 marks?　　　　1

_____

_____

(iii) How many possible combinations of answers are there for the 25 questions, if each question was given another choice (E)?　　　　1

_____

_____

(c) The diagram below represents the earth. O is the centre of the earth and P (45°N, 40°W) and Q (60°S, 40°W) are points on the surface.
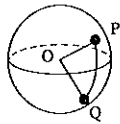
(i) What is the angular distance between P and Q?　　　　1

_____

_____

_____

(ii) What is the distance between P and Q to the nearest kilometre? Express your answer correct to three significant figures.　　　　1

_____

_____

_____

_____

(d) The number of crimes in two suburbs is recorded in the two-way table below.

	Suburb X	Suburb Y	
Personal assaults	34	18	
Crimes with a weapon	22	28	

(i) How many personal assaults were committed in both suburbs?　　　　1

_____

(ii) How many crimes were committed in Suburb Y?　　　　1

_____

(iii) Express the number of personal assaults as a percentage of all crimes. Express your answer to the nearest percent.　　　　1

_____

(iv) What fraction of the crimes for Suburb X involved crimes with a weapon?　　　　1

_____

(e) Mitchell purchased a used car for $16 000. It depreciated by 20% per annum and is expected to be used for 10 years.

(i) What is the salvage value of the car after two years?　　　　1

_____

_____

_____

(ii) How many years will it take for the salvage value of the car be less than $4 000? Answer to the nearest whole year.　　　　2

_____

_____

_____

_____

_____

Question 29 (15 marks)

(a) The diagram shows the position of A, B and C relative to O. In the diagram A is NE of O, C is NW of O, $\triangle COB$ is 115°, CO is 2 m and BO is 3m.
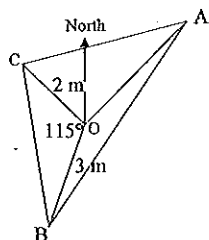
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(i) What is the true bearing of A from O? **1**

(ii) What is the true bearing of B from O? **1**

(iii) What is the distance from B to C? Answer correct to two decimal places. **2**

(iv) What is the area of triangle BOC? Answer correct to two decimal places. **1**

(b) Using the equation $s = at^2$

(i) Find the value of s if $a = 12$ and $t = 16$. **1**

(ii) Rearrange the equation $s = at^2$ to make t the subject. **2**

(iii) Find the value of t if $s = 27$ and $a = 3$ **1**

(c) Hayley is standing on a cliff and looking at the horizon. The distance (d) in kilometres to the horizon from a height (h) in metres is $d = 7.5\sqrt{\dfrac{h}{5}}$.

(i) What is the distance to the horizon if the height is 15 m? Answer correct to one decimal place. **1**

(ii) What is the height if the distance to the horizon is 7.87 km? Answer correct to one decimal place. **2**

(d) *ABC* represents a triangular area of land. The bearing of *A* from *B* is 030° and the bearing of *C* from *B* is 250°. The distance *BC* is 60 m and the distance ∠*ACB* is 27°

030°

A

NOT
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B

27°

60 m

250°   C
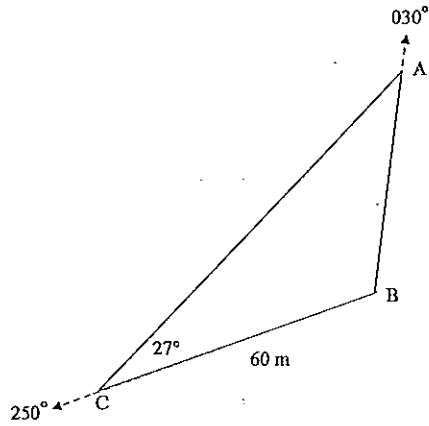
(i)   Find the angle *ABC*   1

(ii)   What is the length of *AC* correct to one decimal place?   2

Question 30 (15 marks)

(a)   The table below shows the approximate coordinates for three cities.

City	Latitude	Longitude
Wollongong	34°S	150°E
Perth	31°S	115°E
Tokyo	35°N	139°E

(i)   What is the time in Wollongong if it is 3 am on a Monday night in Tokyo?   2

(ii)   A car race between Wollongong and Perth takes 89 hours. A car leaves Wollongong at 8 am on Wednesday morning. Find the day and local time this car arrives in Perth. (Ignore time zones).   2

(b) The number of staff employed in eight stores for business A and business B is listed below.

Business A	75	95	45	252	20	145	36	30
Business B	74	82	64	115	56	73	63	90

(i) Find the range and interquartile range for each set of data. **1**

_____

_____

_____

(ii) Find the mean and median for each set of data. **1**

_____

_____

_____

(iii) Which is the better measure for the centre of this data? Explain your answer. **1**

_____

_____

_____

_____

_____

(iv) Compare and contrast the two sets of data. **1**

_____

_____

_____

_____

(c) The scatterplot shows daily physical exercise (e) versus heart disease (h).
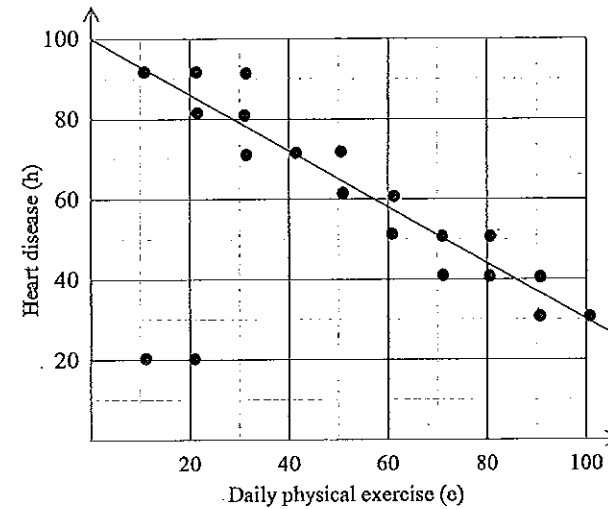
(i) Calculate the gradient of the line. **1**

_____

_____

_____

(ii) What is the equation of the line of best fit drawn? **1**

_____

_____

_____

(iii) Estimate the value of the correlation coefficient. **1**

_____

(d) There is a garden inside the rectangular block of land as shown in the diagram.
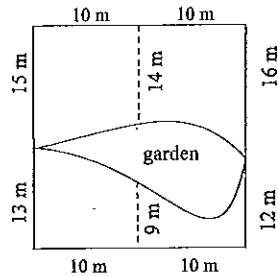
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(i) What is the area of the rectangular block of land?   1

_____

_____

_____

(ii) Use Simpson's Rule to find the approximate area of the garden. Answer correct to one decimal place.   2

_____

_____

_____

_____

_____

_____

(iii) How much soil would be required to raise the garden 30 cm above the remainder of the land?   1

_____

_____

_____

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
$$V = \frac{1}{3}Ah$$
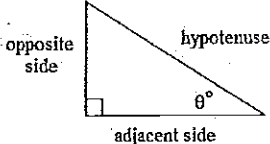A is area of the base
h is perpendicular height

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

Cosine rule
In $\triangle ABC$
$$c^2 = a^2 + b^2 - 2ab\cos C$$
or
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Units of Memory and File Size

1 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

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

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

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

Probability of an Event

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

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

Straight Lines

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

Gradient–intercept form
$$y = mx + b$$
m is gradient
b is y-intercept

ACE Examination Practise Paper 1

HSC Mathematics General 2 Yearly Examination

Worked solutions and marking guidelines

Section 1		
	Solution	**Criteria**
1	Data files $= \dfrac{32 \times 1024}{6.4} = 5120$	1 Mark: D
2	Angle size $= \dfrac{36}{180} \times 360 = 72°$	1 Mark: D
3	$2y^2(y+4) - y^2 = 2y^3 + 8y^2 - y^2$ $\qquad = 2y^3 + 7y^2$	1 Mark: B
4	Gross pay $= 15 \times 16.50 + 4 \times 1.5 \times 16.50$ $\qquad = \$346.50$	1 Mark: C
5	Correlation coefficient of +0.5 is a positive linear relationship with medium strength.	1 Mark: A
6	$\cos\theta = \dfrac{\text{adjacent}}{\text{hypotenuse}} = \dfrac{b}{c}$	1 Mark: D
7	180m = 1 mm or 30m $= \dfrac{1}{6}$ mm 240m $= \dfrac{8}{6}$ mm ≈ 1.33 mm	1 Mark: A
8	$z = \dfrac{x - \bar{x}}{s}$ $\quad$ and $\quad z = \dfrac{x - \bar{x}}{s}$ $\quad = \dfrac{44 - 60}{8} = -2 \qquad = \dfrac{76 - 60}{8} = 2$ 95% of scores have a z-score between -2 and 2	1 Mark: C
9	Tax payable = \$38 500 − \$2 500 = \$36 000 Taxable income between \$18201 and \$37000 (2nd line) \$0 + \$17 800 × 0.19	1 Mark: C
10	Categorical data - Mode	1 Mark: C
11	Meeting A the median is 25. Meeting B the median is 26. Difference in medians is 1.	1 Mark: B
12	$d = \dfrac{5Vt}{18} + \dfrac{V^2}{170}$ $\quad = \dfrac{5 \times 70 \times 0.50}{18} + \dfrac{70^2}{170} \approx 39$ m	1 Mark: C

13	$\dfrac{x}{\sin 61°} = \dfrac{29}{\sin 79°}$ $x = \dfrac{29 \sin 61°}{\sin 79°}$	1 Mark: C
14	Total paid $= 2200 + \$820 \times 12 \times 4$ $\qquad = \$41560$	1 Mark: D
15	Electricity $= 2.1 \times 3.5$ $\qquad = 7.35$ kWh Cost $= 7.35 \times 0.251$ $\qquad = \$1.84$	1 Mark: A
16	Gradient intercept formula: $y = mx + b$. Gradient is 3	1 Mark: C
17	Number of outcomes $= 9 \times 8$ $\qquad = 72$	1 Mark: D
18	S32°E	1 Mark: C
19	Charge $= 0.25 + (300 \div 60) \times 0.94$ $\qquad = \$4.95$	1 Mark: C
20	$N = 1000(2.5^t)$ $\quad = 1000(2.5^2) = 6250$	1 Mark: D
21	$\sqrt{x} - 16 = 20$ $\quad \sqrt{x} = 36$ $\qquad x = 36^2$ $\qquad = 1296$	1 Mark: D
22	Number of litres $= 60 + 39 + 33 + 8 = 140$ L Washing machine $= \dfrac{8}{140} \times 100 \approx 5.7\%$	1 Mark: A
23	$\cos\theta = \dfrac{5^2 + 6^2 - 7^2}{2 \times 5 \times 6}$ $\theta = 78°$	1 Mark: C
24	Drip rate $= \dfrac{1.5 \times 1000}{8} = 187.5$ mL/h	1 Mark: D
25	$A = P(1+r)^n$ $\quad = 4000\left(1 + \dfrac{0.08}{12}\right)^{24} = \$4691.55$ Instalments $= \$4691.55 \div 24$ $\qquad = \$195.48$	1 Mark: A

Section II		
	Solution	**Criteria**
26(a) (i)	$IQR = 23.5 - 17$ $= 6.5$	1 Mark: Correct answer.
26(a) (ii)	Percentage $= 50\%$ (Median)	1 Mark: Correct answer.
26(a) (iii)	Disagree. Median amount of data uploaded (21) is more than the median amount of data downloaded (16). Spread of the data is greater for downloading compared to uploading.	1 Mark: Correct answer.
26(b)	$4a(b+a) - a(b-4a) = 4ab + 4a^2 - ab + 4a^2$ $= 8a^2 + 3ab$	2 Marks: Correct answer. 1 Mark: Expands grouping symbols or adds like terms
26(c) (i)	Fortnightly pay $= 78000 \div 26$ $= \$3000$	1 Mark: Correct answer.
26(c) (ii)	Superannuation $= 9\%$ of $\$3000$ $= \$270$	1 Mark: Correct answer.
26(c) (iii)	Tax deduction $= 8 \times 52 + 90 + 410$ $= \$916$	1 Mark: Correct answer.
26(c) (iv)	Taxable income $= 78000 - 916$ $= \$77\,084$	1 Mark: Correct answer.
26(c) (v)	Medicare levy $= 1.5\%$ of $\$77\,084$ $= 0.015 \times 77084 = \$1156.26$	1 Mark: Correct answer.
26(d) (i)	Number of choices $= 3 \times 2 \times 2$ $= 12$	2 Marks: Correct answer. 1 Mark: Lists the choices or makes some progress
26(d) (ii)		2 Marks: Correct answer. 1 Mark: One stage of the tree diagram is correct.
26(d) (iii)	$P(BPS) = \dfrac{n(BPS)}{n(s)} = \dfrac{1}{12}$	1 Mark: Correct answer.

27(a) (i)	$\$371\,640.00$	1 Mark: Correct answer.
27(a) (ii)	$\$371\,640 \times \left(1 + \dfrac{0.08}{12}\right)^1 - \$2840 = \$371\,277.60$	1 Mark: Correct answer.
27(a) (iii)	$\$\$371\,277.60 \times \dfrac{0.08}{12} = \$2475.18$	1 Mark: Correct answer.
27(a) (iv)	$\$371\,277.60 + \$2475.18 - \$2840 = \$370\,912.78$	1 Mark: Correct answer.
27(b)	Financial expectation $= \text{Sum}[P(E) \times \text{Financial outcome}]$ $= (25\% \times \$100) + (40\% \times \$75) + (35\% \times -\$125)$ $= \$11.25$	2 Marks: Correct answer. 1 Mark: Makes some progress towards solution.
27(c) (i)	$BAC_{Female} = \dfrac{(10N - 7.5H)}{5.5M}$ $= \dfrac{(10 \times 7 - 7.5 \times 5)}{(5.5 \times 65)}$ ≈ 0.0909	2 Marks: Correct answer. 1 Mark: Substitutes one correct value into the formula.
27(d) (i)	$P(GGGG) = \dfrac{n(GGGG)}{n(s)} = \dfrac{1}{16}$	1 Mark: Correct answer.
27(d) (ii)	$P(GGGB) = \dfrac{n(GGGB)}{n(s)} = \dfrac{1}{16}$	1 Mark: Correct answer.
27(d) (iii)	Four outcomes: GGGB, GGBG, GBGG, BGGG $P(3G1B) = \dfrac{1}{16} + \dfrac{1}{16} + \dfrac{1}{16} + \dfrac{1}{16}$ $= \dfrac{1}{4}$	2 Marks: Correct answer. 1 Mark: Makes some progress towards the solution.
27(e)	$V = \dfrac{h}{3}(A_f + 4A_m + A_t)$ $= \dfrac{15}{3} \times (11 + 4 \times 18 + 17)$ $= 500 \text{ m}^3$	1 Mark: Correct answer.
27(f)	$\dfrac{64}{p} = \dfrac{16}{332}$ $16p = 21248$ $p = 1328$ Fish population is approximately 1328.	2 Marks: Correct answer. 1 mark: Uses the capture-recapture method with two correct values.

28(a) (i)	Intersection value is 1.89 (4% and 2 years) $PV = 1.89 \times 6000$ $\qquad = \$11,340$	1 Mark: Correct answer.
28(a) (ii)	Intersection value is 2.58 (8% and 3 years) $47988 = x \times 2.58$ $x = \dfrac{47988}{2.58}$ $\qquad = \$18\,600$ Value of the annuity is \$18 600 per year.	1 Mark: Correct answer.
28(a) (iii)	Intersection value is 3.47 (6% and 4 years) $PV = 3.47 \times 1000$ $\qquad = \$3\,470$	1 Mark: Correct answer.
28(b) (i)	Number of outcomes $= 4 \times 4 \times 4 \times ... \times 4 \times 4$ (25 fours) $\qquad = 4^{25}$ $\qquad = 1.125899907 \times 10^{15}$	1 Mark: Correct answer.
28(b) (ii)	$P(\text{Full marks}) = \dfrac{1}{1.125899907 \times 10^{15}}$	1 Mark: Correct answer.
28(b) (iii)	Number of outcomes $= 5^{25}$ $\qquad = 2.980232239 \times 10^{17}$	1 Mark: Correct answer.
28(c) (i)	Angular distance $= 45 + 60$ $\qquad = 105°$	1 Mark: Correct answer.
28(c) (ii)	$l = \dfrac{105}{360} \times 2 \times \pi \times 6400$ $\quad = 11728.61257$ $\quad = 11\,700$ km	1 Mark: Correct answer.
28(d) (i)	$34 + 18 = 52$	1 Mark: Correct answer.
28(d) (ii)	$18 + 28 = 46$	1 Mark: Correct answer.
28(d) (iii)	Percentage $= \dfrac{52}{102} \times 100$ $\qquad = 51\%$	1 Mark: Correct answer.
28(d) (iv)	Fraction $= \dfrac{22}{56} = \dfrac{11}{28}$	1 Mark: Correct answer.
28(e) (i)	$S = V_0(1-r)^n$ $\quad = 16000 \times (1 - 0.20)^2$ $\quad = \$10\,240$	1 Mark: Correct answer.

28(e) (ii)	$S = V_0(1-r)^n$ $4000 = 16000 \times (1 - 0.20)^n$ $\dfrac{4000}{16000} = 0.80^n$ $0.80^n = 0.25$ $n = \dfrac{\log 0.25}{\log 0.80}$ $\quad = 6.2126$ Number of years is 7 to be less than \$4 000. Note: answer can also be obtained by trial and error.	2 Marks: Correct answer. 1 Mark: Makes significant progress towards the solution
29(a) (i)	True bearing is 045° (A is NE of O)	1 Mark: Correct answer.
29(a) (ii)	To find $\triangle BOA$ $\angle BOA + 115° + 45° + 45° = 360°$ $\qquad \angle BOA = 155°$ True bearing is 200° (155° + 45°)	1 Mark: Correct answer.
29(a) (iii)	$BC^2 = 2^2 + 3^2 - 2 \times 2 \times 3 \times \cos 115°$ $BC^2 = 18.07141914$ $BC = 4.25$ m Distance from B to C is 4.25 m	2 Marks: Correct answer. 1 Mark: Recognises the use of the cosine rule and makes progress.
29(a) (iv)	$A = \frac{1}{2}bc \sin \angle BOC$ $\quad = \frac{1}{2} \times 2 \times 3 \times \sin 115°$ $\quad = 2.718923361$ $\quad = 2.72$ m^2	1 Mark: Correct answer.
29(b) (i)	$s = at^2$ $\quad = 12 \times 16^2$ $\quad = 3072$	1 Mark: Correct answer.
29(b) (ii)	$s = at^2$ $\dfrac{s}{a} = t^2$ $t = \pm\sqrt{\dfrac{s}{a}}$	2 Marks: Correct answer. 1 Mark: Correctly makes t^2 the subject of the equation.
29(b) (iii)	$t = \pm\sqrt{\dfrac{27}{3}}$ $\quad = \pm 3$	1 Mark: Correct answer.

29(c) (i)	$d = 7.5\sqrt{\dfrac{h}{5}}$ $= 7.5 \times \sqrt{\dfrac{15}{5}}$ $= 13.0$ km	1 Mark: Correct answer.
29(c) (ii)	$d = 7.5\sqrt{\dfrac{h}{5}}$ $7.87 = 7.5 \times \sqrt{\dfrac{h}{5}}$ $\dfrac{7.87}{7.5} = \sqrt{\dfrac{h}{5}}$ $\dfrac{h}{5} = \left(\dfrac{7.87}{7.5}\right)^2$ $h = 5 \times \left(\dfrac{7.87}{7.5}\right)^2$ $= 5.5$ m	2 Marks: Correct answer. 1 Mark: Makes significant progress towards the solution.
29(d) (i)	CB makes an angle of $110°$ with the north direction. $\angle ABC = 110° + 30°$ $\qquad = 140°$	1 Mark: Correct answer.
29(d) (ii)	To find $\triangle CAB$ $\angle CAB + 140° + 27° = 180°$ $\qquad \angle CAB = 13°$ $\dfrac{a}{\sin A} = \dfrac{b}{\sin B}$ $\dfrac{AC}{\sin 140°} = \dfrac{60}{\sin 13°}$ $AC = \dfrac{60 \times \sin 140°}{\sin 13°}$ $\qquad = 171.4473253$ $\qquad = 171.4$ m	2 Marks: Correct answer. 1 Mark: Correctly calculates $\triangle CAB$ or makes some progress in the use of the sine rule.

30(a) (i)	Longitude difference $= 150 - 139$ $\qquad\qquad\qquad = 11°$ Time difference $= 11 \times 4$ $\qquad\qquad\qquad = 44$ min Wollongong is 3.00 am + 44 min $\qquad$ or 3.44 am.	2 Marks: Correct answer. 1 Mark: Correctly calculates the time difference.
30(a) (ii)	Longitude difference $= 150° - 115°$ $\qquad\qquad\qquad = 35°$ Time difference $= 35 \times 4$ $\qquad\qquad\qquad = 140$ min $\qquad\qquad\qquad = 2$h 20 min Wollongong is 8.00 am □ 2 h 20 min or 5.40 am Time $= 5.40$ am + 89 h (or 3d 17 h) $\qquad = 3$d 10.40 pm Arrives on Saturday at 10.40 pm	2 Marks: Correct answer. 1 Mark: Correctly calculates the local time in Perth.
30(b) (i)	Business A: Range $= 232$, IQR $= 87$ Business B: Range $= 59$, IQR $= 22.5$	1 Mark: Correct answer.
30(b) (ii)	Business A: Mean $= 87.25$, Median $= 60$ Business B: Mean $= 77.125$, Median $= 73.5$	1 Mark: Correct answer.
30(b) (iii)	Median is a better measure. Mean in Business A has been distorted by an outlier (252).	1 Mark: Correct answer.
30(b) (iv)	Staff numbers of business B is more than the staff numbers of business A. There is a greater spread in the staff numbers of business A compared to the staff numbers of business B.	1 Mark: Correct answer.
30(c) (i)	$m = \dfrac{\text{Rise}}{\text{Run}}$ $= -\dfrac{70}{100} = -0.7$	1 Mark: Correct answer.
30(c) (ii)	$y = mx + b$ $h = -0.7e + 100$	1 Mark: Correct answer.
30(c) (iii)	About -0.8	1 Mark: Correct answer.

30(d) (i)	$A = lb$ (Rectangle) $= 28 \times 20$ $= 560 \text{ m}^2$	1 Mark: Correct answer.
30(d) (ii)	To find the area of land excluding the garden. $A = \frac{h}{3}(d_f + 4d_n + d_l) + \frac{h}{3}(d_f + 4d_n + d_l)$ $= \frac{10}{3}(15 + 4 \times 14 + 16) + \frac{10}{3}(13 + 4 \times 9 + 12)$ $= 493.333... \text{ m}^2$ Area of garden $= 560 - 493.333$ $\approx 66.7 \text{ m}^2$	2 Marks: Correct answer. 1 mark: Makes some progress using Simpson's rule.
30(d) (iii)	$V = Ah$ $= 66.7 \times 0.30$ $\approx 20 \text{ m}^3$	1 Mark: Correct answer.