ACE Examinations

Student Name: _____

Practice Paper 3
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 coordinates of St Petersburg are 60°N, 30°E. What are the coordinates of Oslo if it is 19° west of St Petersburg?

(A) 60°N, 49°E

(B) 60°N, 11° E

(C) 79°N, 30° E

(D) 41°N, 30° E

2 Aiden's solution to the equation $\dfrac{3a-7}{2} = 2a$ is shown below.

$$3a-7 = a$$
$$4a-7 = 0$$
$$4a = 7$$
$$a = \dfrac{7}{4}$$

Where is the error in Aiden's working?

(A) Line 1 and line 2

(B) Line 1 and line 3

(C) Line 2 and line 3

(D) Line 2 and line 4

3 A mobile phone plan has a monthly charge of $39 on a 24-month contract. The call rate is $0.88 per 60-second block plus there is a $0.26 flagfall. What is the cost of making a five-minute call?

(A) $1.20

(B) $4.40

(C) $4.66

(D) $6.00

4 The cost \$C of a birthday party is given by $C = 50n + 95$ where n is the number attending the party. If five people decide not to attend, by how much does the cost decrease?

(A) \$95

(B) \$155

(C) \$250

(D) \$345

5 A field is bordered by three straight fences and a garden as shown below.
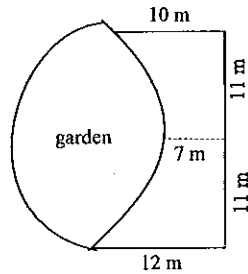
What is the area of the field?

(A) $\dfrac{11}{3}(12 + 7 + 10)$ (B) $\dfrac{11}{3}(12 + 28 + 10)$

(C) $\dfrac{22}{3}(12 + 7 + 10)$ (D) $\dfrac{22}{3}(12 + 28 + 10)$

6 The scale on an aerial photograph is given as 1 mm = 200 m. If the length of land is 350 m, what is the map length between these points?

(A) 0.25 mm

(B) 0.57 mm

(C) 1.75 mm

(D) 2 cm

7 The number of residents at Ashcroft is expected to increase using the formula $N = 3000t^3$, where N is the number of residents and t is the time in years. What is the expected number of residents of Ashcroft after three years?

(A) 9000

(B) 27 000

(C) 78 000

(D) 81 000

8 Grace and William purchased a campervan for \$87 500. It depreciates at 16% per year. How much has the campervan depreciated over four years?

(A) \$31,500.00

(B) \$43,563.74

(C) \$43,936.26

(D) \$56,000.00

9 The normal distribution shows the results of a mathematics assessment task. It has a mean of 60 and a standard deviation of 10
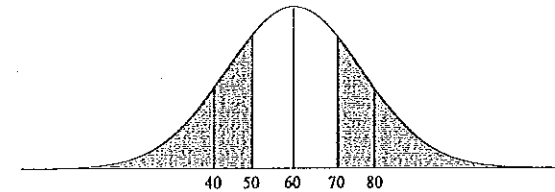
What percentage of results lies in the shaded region?

(A) 16%

(B) 32%

(C) 34%

(D) 68%

10 The profit (\$millions) for two businesses during the first and second quarters is recorded in the table below.

	Business A	Business B
First quarter	252	324
Second quarter	468	490

What fraction of profits for Business B was achieved in the first quarter?

(A) $\dfrac{324}{576}$

(B) $\dfrac{252}{576}$

(C) $\dfrac{324}{814}$

(D) $\dfrac{490}{814}$

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

(A) Zero correlation.

(B) Constant correlation

(C) Negative correlation.

(D) Positive correlation.

12 The following cumulative frequency table shows the results of a test out of 15

Score (x)	Frequency (f)	Cumulative Frequency
9	5	5
10	4	9
11	7	16
12	2	18
13	2	20
14	8	28
15	4	32

What is the median?

(A) 11.5

(B) 12

(C) 13

(D) 14

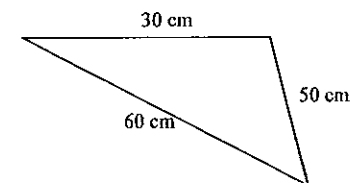13 A motor vehicle is bought for $40 850. What is the stamp duty payable if the charge is $5 per $200 or part $200?

(A) $1020.00

(B) $1021.25

(C) $1025.00

(D) $2050.00

14 Isaac's class achieved a 72% mean and 8% standard deviation for their project work. What was Isaac's mark if he achieved a z-score of –2.5?
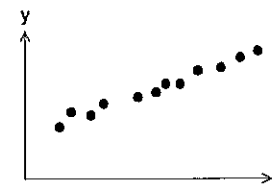
(A) 52%

(B) 64%

(C) 80%

(D) 92%

15 The following triangle has sides 30 cm, 50 cm and 60 cm.

30 cm

50 cm

60 cm

Angle C is the largest angle. Which of the following expressions is correct for angle C?

(A) $\cos C = \dfrac{30^2 + 60^2 - 50^2}{2 \times 30 \times 60}$

(B) $\cos C = \dfrac{50^2 + 30^2 - 60^2}{2 \times 50 \times 30}$

(C) $\cos C = \dfrac{50^2 + 60^2 - 30^2}{2 \times 50 \times 60}$

(D) $\cos C = \dfrac{50^2 + 30^2 - 60^2}{2 \times 50 \times 60}$

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

(A) Low negative

(B) Low positive

(C) High negative

(D) High positive

17 A bag contains 11 balls of which 4 are blue and the rest are white. One ball is selected at random and removed from the bag. Another ball is selected and removed from the bag. What is the probability that both balls are white?

(A) $\dfrac{42}{110}$

(B) $\dfrac{49}{110}$

(C) $\dfrac{42}{122}$

(D) $\dfrac{49}{122}$

18 Use the table below to calculate the present value of an annuity where $12,000 is contributed each year for six years into an account earning 3% per annum compound interest.

Present value of $1				
End of year	3%	4%	5%	6%
5	4.5797	4.4518	4.3295	4.2124
6	5.4172	5.2421	5.0757	4.9173
7	6.2303	6.0021	5.7864	5.5824
8	7.0197	6.7327	6.4632	6.2098

(A) $15,183.83

(B) $54,956.40

(C) $65,006.40

(D) $72,000.00

19 Luke has been quoted $1120 for comprehensive car insurance. He has a no claim bonus of 60%. How much is Luke required to pay?

(A) $448

(B) $672

(C) $1080

(D) $1180

20 Ivy travels from Prague (50°N, 15°E) to the Congo (4°S, 15°E).
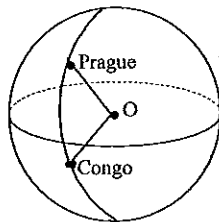
What is the distance from Prague to Congo? Answer to the nearest kilometre.

(A) 2569 km

(B) 3016 km

(C) 5138 km

(D) 6032 km

21 Simplify $7-3(2x-4)$

(A) $-6x$

(B) $-5-6x$

(C) $8x-16$

(D) $19-6x$

22 The table below shows the future value on $1 compounding at the interest rate per period.

Future value of $1				
End of year	4%	6%	8%	10%
1	1.00	1.00	1.00	1.00
2	2.04	2.06	2.08	2.10
3	3.12	3.18	3.25	3.31
4	4.25	4.37	4.51	4.64

Calculate the future value of a $32 000 annuity for 4 years at 8% p.a. compounded annually.

(A) $42 240

(B) $45 536

(C) $136 000

(D) $144 320

23 A radial survey is shown below.
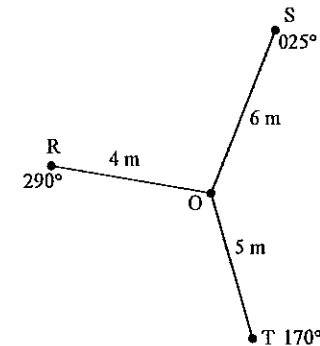
Find the area of the $\triangle ROS$ correct to the nearest square metre.

(A) 5 m^2 (B) 9 m^2

(C) 11 m^2 (D) 12 m^2

24 How long will it take a vehicle to travel 395 km at a speed of 65 km/h? Answer to the nearest minute.

(A) 10 minutes

(B) 5 hours 30 minutes

(C) 6 hours 5 minutes

(D) 6 hours 10 minutes

25 A sample of three people is taken from a group of five people. How many samples are possible?

(A) 3

(B) 5

(C) 9

(D) 10

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) The numbers 3, 4 and 5 are written on three cards. One card is selected at random to form the hundreds digit, a second card to form the tens digit and the third digit to form the units digit.
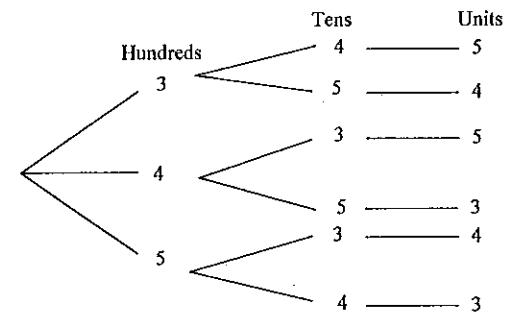
(i)   What is the probability that the number formed is 543?   **1**

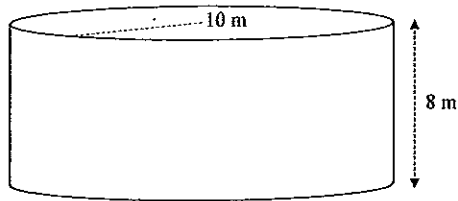(ii)   What is the probability that the number starts with a 3?   **1**

(iii) What is the probability that the number formed is even?   **1**

(b) A water tank is in the shape of a closed cylinder with a radius of 10 m and height of 8 m as shown below.


(i) What is the area of the curved surface of the water tank? Answer correct to one decimal place.   1

(ii) What is the area of the top circular face of the water tank? Answer correct to one decimal place.   1

(iii) Determine the total surface area of the water tank. Answer correct to one decimal place.   1

(c) Given the formula $V = \dfrac{2}{r^2} + k$

(i) Make k the subject of the formula.   1

(ii) If $V = 9$ and $r = 4$, what is the value of k?   1

(d) Robert recorded the distances he ran during weeks 1 and 2 of his holidays. The box-and-whisker plot at the top is week 1.
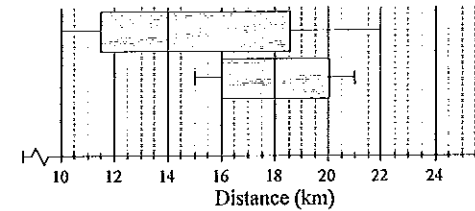
(i) What was the longest distance he ran?   1

(ii) What is the median distance for the second week?   1

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

(e) A meteorite reaches earth from outer space. The distance (d metres) it travels through the earth's atmosphere varies directly as the square of the time (t seconds) it has been travelling. The meteorite travels 3600 metres in the first 20 seconds.

(i) How far did the meteorite travel in the first 7 seconds?   1

(ii) How long will it take for the meteorite to travel 19 800 metres? Answer correct to one decimal place.   1

(f)   The angle of pitch of a roof is 23° as shown below.
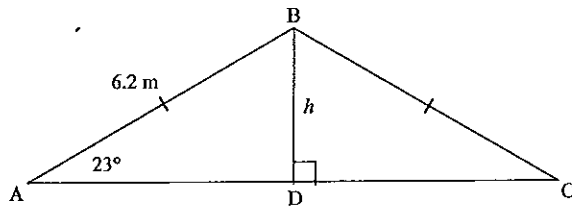
(i)   What is the perpendicular height of the roof? Answer correct to three   **1**
significant figures.

(ii)   What is the width of the roof? Answer correct to one decimal place.   **1**

Question 27 (15 marks)   **Marks**

(a)   The age of an investment (n) in years is linked by a line of fit to its current
value (v) in $1000 by $v = 21 + 3n$. Use this equation to predict the:

(i)   Value of the investment after three years.   **1**

(ii)   Age of the investment if its value is $48 000.   **1**

(b)   The approximate latitude and longitude of two cities is shown below.

	Latitude	Longitude
Houston	30°N	95°W
Multan	30°N	71°E

(i)   What is the difference in time between Houston and Multan?   **1**

(ii)   Tyler is on holidays in Multan and his sister Ruth lives in Houston.   **1**
What is the time in Houston if it is 2 pm on a Monday in Multan?

(iii) Tyler decides to return from his holiday in Multan and travel to   **1**
Houston. Calculate the distance between Multan and Houston to the
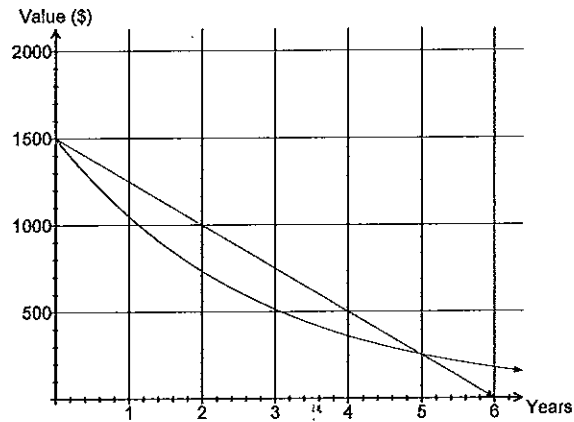nearest kilometre. Assume the radius of the earth is 6400 km.

(c) The depreciation of a used car using both the straight-line and declining balance methods of depreciation is shown in the graph below.

Value ($)

(i) How much does the used car decrease in value each year using the straight-line method?   **1**

(ii) What is the salvage value of the used car after three years using the declining balance method?   **1**

(iii) Which method of depreciation would provide the largest depreciation for a tax deduction if the asset is to be kept for six years   **1**

(d) Emily borrows $2700 to buy a dinning table. Her repayments are $135 a month for two years.

(i) What interest does Emily pay?   **1**

(ii) What flat rate of interest per annum has Emily been charged?   **1**

(e) Given the formula $M = \dfrac{\sqrt{k}}{3p}$.

(i) Find the value of M when $k = 4 \times 10^6$ and $p = 7 \times 10^3$. Answer correct to four decimal places.   **1**

(ii) Find the value of p when $M = 8 \times 10^5$ and $k = 9 \times 10^{-9}$. Answer in scientific notation correct to one significant figure.   **1**

(f) Zara plays a game by throwing an unbiased die. The rules of the game are as follows.

      o Zara wins $90 by throwing a six.
      o Zara wins $12 by throwing a four or a five
      o Zara loses $40 by throwing a number less than four.

(i)   How many times would you expect a six if the die is thrown 240 times?   **1**

(ii) What is the probability of throwing a four or a five?   **1**

(iii) What is the financial expectation of this game?   **1**

Question 28 (15 marks)   **Marks**

(a) $\triangle TUV$ has sides $UV = 32$ mm, $TV = 76$ mm and $\angle TUV = 114°$.
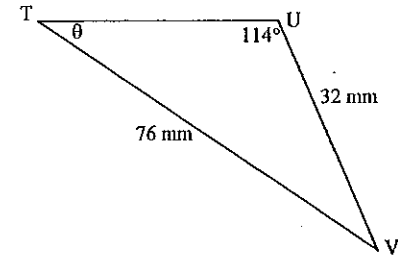
(i)   What is the size of $\angle VTU$? Give your answer to the nearest degree.   **1**

(ii) What is the area of $\triangle TUV$? Answer to the nearest square millimetre.   **2**

(b) The time taken (t) to fit insulation in a school varies inversely with the number (n) of people employed. It takes 5 people 2 days to fit insulation in a school.

(i)   How long does it take 4 people to fit the same insulation in the school?   **2**

(ii) How many people are required to fit the insulation in 1 day?   **1**

(c) Mark recorded the number of hits on his web site for the past ten days.

45, 52, 50, 41, 38, 23, 27, 47, 52, 56

    (i)   Calculate the mean number of hits on Mark's web site?   1

    (ii)   What is the mode for this data?   1

    (iii)   What is the median number of hits for the past ten days?   1

    (iv)   Which of the above measures of location will not change if 56 is deleted?   1

(d) Nelson's industrial unit produces aluminium rods. In the past week the industrial unit has produced aluminium rods with a mean weight of 12.5 kilograms and a standard deviation of 0.5 kilograms.

    (i)   Quality control requires any aluminium rod with a z-score less than -1 to be rejected. What is the minimum weight that will be accepted?   1

    (ii)   Aluminium rods with a z-score greater than 2 are also rejected. What is the maximum weight that will be accepted?   1

(e) Charlotte is 57 kg and has consumed 5 standard drinks in the past four hours. She was stopped by police for a random breath test.

    (i)   What would be Charlotte's blood alcohol content? Answer correct to 2 decimal places.   1

    (ii)   Is she over the limit? Give a reason.   1

(f) A solar PV system exports 18.1 kWh per day of energy to the grid. An energy retailer pays $0.08 per kWh for energy. What is the expected saving from the solar PV system for the year?   1

Question 29 (15 marks)   Marks

(a) Evaluate these expressions given $a = 2$, $b = 5$ and $c = 6$

    (i) $3a - b + 2c$ 1

    (ii) $\sqrt{3ac}$ 1

    (iii) $\dfrac{ab^2 - 2}{c}$ 1

(b) Mr Nguyen is ordering six students for a group photo. The students will sit in a row.

    (i)   How many different ways can Mr Nguyen arrange the six students?   1

    (ii)   Jessica is one of the students. What is the probability that she will be sitting at the start of the row?   1

(c) Clark's rule is used to prescribe medicine for children.

The formula is: $\text{Dosage} = \dfrac{\text{Weight (kg)} \times \text{Adult dose}}{70}$

    (i)   What is dosage for a child 25 kg if the adult dosage is 20 mL?   1

    (ii)   What is the adult dosage if a child 35 kg has a dosage of 15 mL?   1

(d) There are 52 cards in a normal playing pack. An experiment involves selecting a card at random. This experiment is repeated 78 times with the card being replaced each time.

    (i)   What is the probability of selecting a heart?   1

    (ii)   What is the probability of selecting a two or a three?   1

    (iii) How many two's or three's would be expected in this experiment?   1

(e) Ann uses a 900W microwave for a total of 36 hours. What is the cost of using the microwave if electricity is $0.2435 per kWh?   2

(f) (i) Tom invests $9 000 over 5 years at a compound interest rate of   **1**
4.6%p.a. Calculate the future value after 5 years. Answer correct to
the nearest cent.

_____

_____

_____

_____

_____

(ii) Calculate the present value of an annuity whose future value is   **2**
$480,000 over 8 years with an interest rate of 8.2% per annum
compounded monthly. Answer correct to the nearest cent.

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_____

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Question 30 (15 marks)   **Marks**

(a) Alice's credit card statement for April shows an opening balance of $8 400, a
purchase of $780 on April 5, and another of $250 on April 15. The minimum
payment each month is 3% on the closing balance. The credit card has an
interest rate of 24% p.a.

(i) What is closing balance on this credit card for April?   **1**

_____

_____

_____

_____

(ii) What is the minimum payment required for the month of April?   **1**

_____

_____

_____

(iii) Calculate the amount owing at the end of May if Alice paid the   **1**
minimum amount for April and made no purchases in May?

_____

_____

_____

_____

(b) A television program achieved the following ratings for the past nine weeks:
34, 28, 29, 36, 22, 26, 30, 28 and 31. All ratings are a percentage of the total
audience.

(i) What is the population standard deviation for these times? Answer   **1**
correct to two decimal places.

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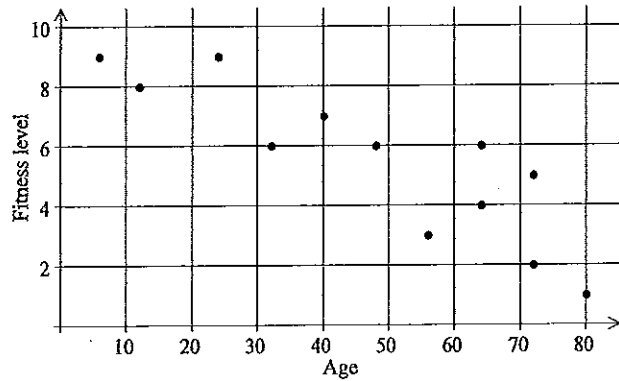(ii) Determine the interquartile range for these times.   **1**

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_____

_____

(c) The scatterplot below shows the relationship between Age and fitness level.

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

(ii)   Describe the correlation between these quantities.   **1**

(d) Mick participates in a penalty shootout. He has two shots at goal. The probability that he scores a goal with a penalty shot is 65%.

(i)   What is the probability that Mick misses a penalty with his first shot?   **1**

(ii)   Calculate the probability that Mick scores a goal with both shots.   **1**

(iii) What is the probability that Mick scores only one goal?   **1**
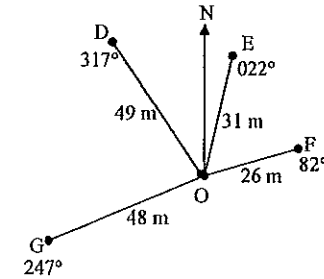
(e) A radial survey of land *DEFG* is shown below

(i)   What is the size of $\angle DOG$?   **1**

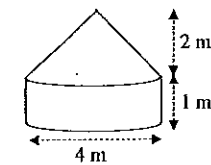(ii)   What is the length of *DG* correct to the nearest metre?   **2**

(f) A solid consists of a cylinder and a cone as shown. What is the volume of the solid correct to one decimal place?   **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
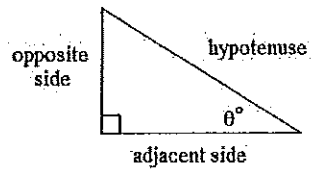
$$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

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

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

Sine rule

In $\triangle ABC$

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

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

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

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

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 Practice Paper 3

HSC Mathematics General 2 Yearly Examination
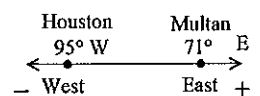
Worked solutions and marking guidelines

Section 1

	Solution	Criteria
1	Subtract 19 from the longitude of St Petersburg. 60°N, (30-19)° E or 60°N, 11° E	1 Mark: B
2	$3a - 7 = 4a$ $-1a - 7 = 0$ $-1a = 7$ $a = -7$	1 Mark: A
3	Charge $= 0.26 + (300 \div 60) \times 0.88$ $= \$4.66$	1 Mark: C
4	$C = 50n$ ($\$50$ per person) $= 50 \times 5 = \$250$	1 Mark: C
5	$A = \dfrac{h}{3}(d_f + 4d_m + d_l)$ $= \dfrac{11}{3}(12 + 4 \times 7 + 10)$	1 Mark: B
6	$200 \text{ m} = 1 \text{ mm}$ $50 \text{ m} = \dfrac{1}{4} \text{ mm}$ $350 \text{ m} = \dfrac{7}{4} \text{ mm}$ $= 1.75 \text{ mm}$	1 Mark: C
7	$N = 3,000t^3$ $= 3,000 \times 3^3$ $= 81,000$	1 Mark: D
8	$S = V_0(1-r)^n$ $= 87500 \times (1 - 0.16)^4$ $= \$43563.74$ Depreciation $= S - V_0$ $= 87500 - 43563.74$ $= \$43936.26$	1 Mark: C
9	Region is outside one standard deviation 100% - 68% = 32%	1 Mark: B
10	Profits business B = 324 + 490 = 814. $\dfrac{\text{First quarter}}{\text{Total profits}} = \dfrac{324}{814}$	1 Mark: C
11	Increased living standards results in an increase in life expectancy. Positive correlation.	1 Mark: D
12	Median is the middle score. There are 32 scores, the middle score is between the 16th and 17th score or 11.5.	1 Mark: A
13	Value of vehicle = $\$41\ 000$ $\$5$ per $\$200$ is the fraction $\frac{5}{200}$. Stamp duty $= \$41000 \times \dfrac{5}{200}$ $= \$1025$	1 Mark: C
14	$z = \dfrac{x - \bar{x}}{s}$ $-2.5 = \dfrac{x - 72}{8}$ $x = (-2.5 \times 8) + 72$ $= 52$	1 Mark: A
15	Largest angle is opposite the largest side. $\cos C = \dfrac{50^2 + 30^2 - 60^2}{2 \times 50 \times 30}$	1 Mark: B
16	High positive.	1 Mark: D
17	$P(WW) = \dfrac{7}{11} \times \dfrac{6}{10}$ $= \dfrac{42}{110}$	1 Mark: A
18	$PV = 5.4172 \times 12000$ $= \$65006.40$	1 Mark: C
19	Premium = 40% of $\$1120$ $= 0.40 \times \$1120 = \$448$	1 Mark: A
20	Latitude difference $= 50° + 4° = 54°$ $l = \dfrac{54}{360} \times 2\pi \times 6400$ $= 6031.857895...$ $\approx 6032 \text{ km}$	1 Mark: D
21	$7 - 3(2x - 4) = 7 - 6x + 12$ $= 19 - 6x$	1 Mark: D

22	$FV = 4.51 \times \$32000$ $= \$144\ 320$	1 Mark: D
23	$A = \frac{1}{2}ab\sin C$ $= \frac{1}{2} \times 4 \times 6 \times \sin 95°$ $= 11.95433638...$ $\approx 12\ m^2$	1 Mark: D
24	$T = \frac{D}{S}$ $= \frac{395}{65}$ $= 6.076923077$ $\approx 6\ h\ 5\ min$	1 Mark: C
25	{ABC, ABD, ABE, ACD, ACE, ADE, BCD, BCE, BDE, CDE} or $^5C_3$. 10 samples	1 Mark: D

Section II

	Solution	Criteria
26(a) (i)	$P(543) = \frac{1}{6}$	1 Mark: Correct answer.
26(a) (ii)	$P(3) = \frac{1}{3}$	1 Mark: Correct answer.
26(a) (iii)	$P(\text{Even}) = \frac{2}{6} = \frac{1}{3}$	1 Mark: Correct answer.
26(b) (i)	$A = 2\pi rh$ $= 2 \times \pi \times 10 \times 8$ $= 502.6548246... \approx 502.7\ m^2$	1 Mark: Correct answer.
26(b) (ii)	$A = \pi r^2$ $= \pi \times 10^2$ $= 314.1592654... \approx 314.2\ m^2$	1 Mark: Correct answer.
26(b) (iii)	$SA = 2\pi r^2 + 2\pi rh$ $= 2 \times \pi \times 10^2 + 2 \times \pi \times 10 \times 8$ $= 1130.973355...$ $\approx 1131.0\ m^2$	1 Mark: Correct answer.
26(c) (i)	$V = \frac{2}{r^2} + k$ $V - \frac{2}{r^2} = k$ or $k = V - \frac{2}{r^2}$	1 Mark: Correct answer.
26(c) (ii)	$k = V - \frac{2}{r^2}$ $= 9 - \frac{2}{4^2}$ $= 8.875$	1 Mark: Correct answer.
26(d) (i)	The longest distance ran is 22 km	1 Mark: Correct answer.
26(d) (ii)	Median = 18 km	1 Mark: Correct answer.
26(d) (iii)	The second week has a greater median (median of 18 compared to first week with a median of 14). However the second week has a smaller spread (IRQ of 4 compared to first week with an IQR of 12.	1 Mark: Correct answer.
26(e) (i)	$d = kt^2$ $d = 9t^2$ $3600 = k \times 20^2$ $= 9 \times 7^2$ $k = \frac{3600}{20^2}$ $= 441$ metres $= 9$	1 Mark: Correct answer.

26(e)(ii)	$d = 9t^2$ $19800 = 9 \times t^2$ $t^2 = \dfrac{19800}{9}$ $t = \sqrt{2200}$ $= 46.9041576... \approx 46.9$ sec	1 Mark: Correct answer.
26(f)(i)	$\sin 23° = \dfrac{h}{6.2}$ $h = 6.2 \times \sin 23$ $= 2.422532997...$ ≈ 2.42 m	1 Mark: Correct answer.
26(f)(ii)	$\cos 23° = \dfrac{AD}{6.2}$ $AD = 6.2 \times \cos 23°$ $= 5.707130091...$ Width of roof $= 2 \times 5.7071...$ $= 11.41426...$ ≈ 11.4 m	1 Mark: Correct answer.
27(a)(i)	$v = 21 + 3n$ $= 21 + 3 \times 3$ $= 30$ Value is \$30 000	1 Mark: Correct answer.
27(a)(ii)	$v = 21 + 3n$ $48 = 21 + 3n$ $3n = 27$ $n = 9$ Age of the investment is 9 years.	1 Mark: Correct answer.
27(b)(i)	Longitude difference $= 95° + 71° = 166°$ Time difference $= 166 \times 4$ $= 664$ min or 11 h 4 min	1 Mark: Correct answer.
27(b)(ii)	Houston Multan 95° W 71° E — West East + Houston is west of Multan. Subtract the time difference. Houston $= 2.00$ pm $- 11$ h 4 min $= 2.56$ am on Monday	1 Mark: Correct answer.
27(b)(iii)	$l = \dfrac{\theta}{360} \times 2\pi r$ $= \dfrac{166}{360} \times 2 \times \pi \times 6400$ $= 18542.37797... \approx 18542$ km	1 Mark: Correct answer.
27(c)(i)	$D = \dfrac{\$1500}{6} = \$250$ (from the graph)	1 Mark: Correct answer.
27(c)(ii)	$S = \$500$ (from the graph)	1 Mark: Correct answer.
27(c)(iii)	$S = \$0$ (Straight-line method) $S = \$200$ (Declining balance method) $\therefore$ Straight-line method provides the largest depreciation.	1 Mark: Correct answer.
27(d)(i)	Total paid $=$ Loan repayment $\times$ Number of repayments $= \$135 \times 12 \times 2 = \$3240$ $I = A - P$ $= \$3240 - \$2700$ $= \$540$	1 Mark: Correct answer.
27(d)(ii)	$I = Prn$ $\$540 = \$2700 \times r \times 2$ $r = 0.1$ $= 10\%$	1 Mark: Correct answer.
27(e)(i)	$M = \dfrac{\sqrt{k}}{3p}$ $= \dfrac{\sqrt{4 \times 10^6}}{3 \times 7 \times 10^2}$ $= 0.9523809524... \approx 0.9523$	1 Mark: Correct answer.
27(e)(ii)	$M = \dfrac{\sqrt{k}}{3p}$ $8 \times 10^5 = \dfrac{\sqrt{9 \times 10^{-9}}}{3 \times p}$ $3p = \dfrac{\sqrt{9 \times 10^{-9}}}{8 \times 10^5}$ $p = \left(\dfrac{\sqrt{9 \times 10^{-9}}}{8 \times 10^5} \right) \div 3$ $= 3.952847.... \times 10^{-11} \approx 4 \times 10^{-11}$	1 Mark: Correct answer.
27(f)(i)	Expect outcomes $=$ P(6) $\times$ No of trials $= \dfrac{1}{6} \times 240 = 40$	1 Mark: Correct answer.
27(f)(ii)	P(4 or 5) $= \dfrac{2}{6} = \dfrac{1}{3}$	1 Mark: Correct answer.
27(f)(iii)	Financial expect $=$ Sum [P(E) $\times$ Financial outcome] $= (\dfrac{1}{6} \times 90) + (\dfrac{2}{6} \times 12) - (\dfrac{3}{6} \times 40)$ $= 15 + 4 - 20$ $= -\$1$	1 Mark: Correct answer.

28(a)(i)	$\dfrac{\sin A°}{a} = \dfrac{\sin B°}{b}$ $\dfrac{\sin \theta}{32} = \dfrac{\sin 114°}{76}$ $\sin \theta = \dfrac{32 \times \sin 114°}{76}$ $= 0.384650719$ $\theta = 22.62205819... \approx 23°$	1 Mark: Correct answer.
28(a)(ii)	To find $\angle UVT$ $\angle UVT + 114° + 22.622...° = 180°$ $\angle UVT = 43.377941...°$ $A = \dfrac{1}{2}ab\sin C$ $= \dfrac{1}{2} \times 32 \times 76 \times \sin 43.377941...°$ $= 835.15820... \approx 835 \text{ mm}^2$	2 Marks: Correct answer. 1 Mark: Finds $\angle UVT$ or uses area of a triangle formula with one correct value.
28(b)(i)	$t = \dfrac{k}{n}$ $\qquad\qquad$ $t = \dfrac{10}{n}$ $2 = \dfrac{k}{5}$ $\qquad\qquad$ $= \dfrac{10}{4}$ $k = 10$ $\qquad\qquad$ $= 2.5$ days	2 Marks: Correct answer. 1 Mark: Finds the value of k.
28(b)(ii)	$t = \dfrac{10}{n}$ $1 = \dfrac{10}{n}$ $n = 10$ people	1 Mark: Correct answer.
28(c)(i)	Mean = 43.1	1 Mark: Correct answer.
28(c)(ii)	Mode = 52	1 Mark: Correct answer.
28(c)(iii)	23, 27, 38, 41, 45, 47, 50, 52, 52, 56 Median = 46	1 Mark: Correct answer.
28(c)(iv)	Mode remains at 52.	1 Mark: Correct answer.
28(d)(i)	$z = \dfrac{x - \bar{x}}{s}$ $-1 = \dfrac{x - 12.5}{0.5}$ $x = (-1 \times 0.5) + 12.5$ $= 12$ Minimum weight to be accepted is 12 kg	1 Mark: Correct answer.
28(d)(ii)	$z = \dfrac{x - \bar{x}}{s}$ $2 = \dfrac{x - 12.5}{0.5}$ $x = (2 \times 0.5) + 12.5$ $= 13.5$ Maximum weight to be accepted is 13.5 kg.	1 Mark: Correct answer.
28(e)(i)	$BAC_{Female} = \dfrac{(10N - 7.5H)}{5.5M}$ $= \dfrac{(10 \times 5 - 7.5 \times 4)}{(5.5 \times 57)}$ $= 0.06379585...$ ≈ 0.06	1 Mark: Correct answer.
28(e)(ii)	Charlotte BAC of 0.6 is over the limit of 0.05.	1 Mark: Correct answer.
28(f)	Expected saving $= 18.1 \times 0.08 \times 365$ $= \$528.52$ The expected saving from the solar PV system is \$528.52	1 Mark: Correct answer.
29(a)(i)	$3a - b + 2c = 3 \times 2 - 5 + 2 \times 6$ $= 6 - 5 + 12$ $= 13$	1 Mark: Correct answer.
29(a)(ii)	$\sqrt{3ac} = \sqrt{3 \times 2 \times 6}$ $= \sqrt{36}$ $= 6$	1 Mark: Correct answer.
29(a)(iii)	$\dfrac{ab^2 - 2}{c} = \dfrac{2 \times 5^2 - 2}{6}$ $= \dfrac{48}{6}$ $= 8$	1 Mark: Correct answer.
29(b)(i)	Outcomes $= 6 \times 5 \times 4 \times 3 \times 2 \times 1$ $= 720$	1 Mark: Correct answer.
29(b)(ii)	P(Jessica) $= \dfrac{1}{6}$	1 Mark: Correct answer.
29(c)(i)	Dosage $= \dfrac{\text{Weight (kg)} \times \text{Adult dose}}{70}$ $= \dfrac{25 \times 20}{70}$ $= 7.142857143...$ $\approx 7 \text{ mL}$ Child dosage is about 7 mL.	1 Mark: Correct answer.

29(c) (ii)	$\text{Dosage} = \dfrac{\text{Weight (kg)} \times \text{Adult dose}}{70}$ $15 = \dfrac{35 \times x}{70}$ $x = \dfrac{15 \times 70}{35} = 30 \text{ mL}$ Adult dosage is 30 mL	1 Mark: Correct answer.
29(d) (i)	$P(\text{Heart}) = \dfrac{13}{52} = \dfrac{1}{4}$	1 Mark: Correct answer.
29(d) (ii)	$P(2 \text{ or } 3) = \dfrac{8}{52} = \dfrac{2}{13}$	1 Mark: Correct answer.
29(d) (iii)	Expect outcomes = $P(2 \text{ or } 3) \times$ Number of trials $= \dfrac{2}{13} \times 78 = 12$	1 Mark: Correct answer.
29(e)	Electricity $= 0.9 \times 36$ $= 32.4 \text{ kWh}$ Cost $= 32.4 \times 0.2435$ $= 7.8894 \approx \$7.89$ Cost of using the microwave is \$7.89.	2 Marks: Correct answer. 1 Mark: Finds the amount of electricity used by the microwave.
29(f) (i)	$FV = PV(1+r)^n$ $= 9000(1+0.046)^5$ $= 11269.40358...$ $\approx \$11,269.40$ Future value is \$11 269.40	1 Mark: Correct answer.
29(f) (ii)	$PV = \dfrac{FV}{(1+r)^n} = \dfrac{480000}{(1+\frac{0.082}{12})^{96}}$ $= 249639.3506...$ $\approx \$249,639.35$ Present value is \$249 639.35	2 Marks: Correct answer. 1 Mark: Finds the interest rate per month or the time period.
30(a) (i)	Balance $= \$8400 + \$780 + \$250$ $= \$9430$	1 Mark: Correct answer.
30(a) (ii)	Minimum payment $= 9430 \times 0.03 \times 1$ $= \$282.90$	1 Mark: Correct answer.
30(a) (iii)	$A = P(1+r)^n$ $= (\$9430 - \$282.90)\left(1+\dfrac{0.24}{12}\right)^1$ $= \$9330.04$ Amount owing is \$9330.04	1 Mark: Correct answer.

30(b) (i)	Enter data into the calculator. $\sigma_n = 3.92$	1 Mark: Correct answer.
30(b) (ii)	22, 26, 28, 28, 29, 30, 31, 34, 36 $Q_1 = 27$, $Q_3 = 32.5$ $IQR = Q_3 - Q_1$ $= 32.5 - 27 = 5.5$	1 Mark: Correct answer.
30(c) (i)	A range of correct answers is possible. Teacher check. Gradient is approximately $-\dfrac{1}{8}$	1 Mark: Correct answer.
30(c) (ii)	High negative correlation.	1 Mark: Correct answer.
30(d) (i)	$P(E) = 100\% - 65\%$ $= 35\%$	1 Mark: Correct answer.
30(d) (ii)	$P(GG) = \dfrac{65}{100} \times \dfrac{65}{100}$ $= \dfrac{169}{400}$	1 Mark: Correct answer.
30(d) (iii)	$P(GM \text{ or } MG) = \dfrac{65}{100} \times \dfrac{35}{100} + \dfrac{35}{100} \times \dfrac{65}{100}$ $= \dfrac{91}{200}$	1 Mark: Correct answer.
30(e) (i)	$\angle DOG = 317° - 247°$ $= 70°$	1 Mark: Correct answer.
30(e) (ii)	$a^2 = b^2 + c^2 - 2bc\cos A$ $DG^2 = 49^2 + 48^2 - 2 \times 49 \times 48 \times \cos 70°$ $DG = 55.64294426...$ $\approx 56 \text{ m}$	2 Marks: Correct answer. 1 Mark: Uses cosine rule with one correct value.
30(f)	$V = \dfrac{1}{3}\pi r^2 h$ (Cone) $= \dfrac{1}{3} \times \pi \times 2^2 \times 2$ $= 8.37758041... \text{ m}^3$ $V = \pi r^2 h$ (Cylinder) $= \pi \times 2^2 \times 1$ $= 12.56637061... \text{ m}^3$ $V = \text{Cone} + \text{Cylinder}$ $= 8.37758041... + 12.56637061...$ $\approx 20.9 \text{ m}^3$	2 Marks: Correct answer. 1 Mark: Makes some progress towards the solution.