Neap:

HSC Trial Examination 2010

General Mathematics

This paper must be kept under strict security and may only be used on or after the morning of Monday 9 August, 2010 as specified in the Neap Examination Timetable.

General Instructions

Reading time – 5 minutes

Working time – 2½ hours

Write using black or blue pen

Calculators may be used

A formulae sheet is provided at the back of this paper

Total marks – 100

Section I Pages 2–8

22 marks

Attempt Questions 1–22

Allow about 30 minutes for this section

Section II Pages 9–16

78 marks

Attempt Questions 23–28

Allow about 2 hours for this section

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2010 HSC General Mathematics Examination.

Section I

22 marks
Attempt Questions 1–22.
Allow about 30 minutes for this section.

Use the multiple-choice answer sheet for Questions 1–22.

1. The following stem-and-leaf graph represents boys' and girls' heights.

Boys		Girls
	15	6 9
9 9	16	0 2 5 8
9 8 7 5	17	1 1 4
7 7 5 3 3 1	18	0
6 4 2	19	
0	20	

What is the range of scores for the girls?

(A) 11
(B) 24
(C) 31
(D) 44

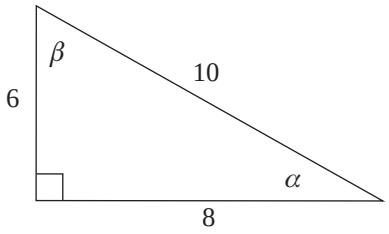
2. A dress is marked down by 20%. If the dress was originally priced at $70.00, how much did it cost when it was marked down?

(A) $14
(B) $50
(C) $56
(D) $90

3. Which of the following represents a number to 3 decimal places?

(A) 0.0003
(B) 0.003
(C) 0.03
(D) 0.3

4. Which of the following is NOT true?



(A) $\sin\alpha = \frac{3}{5}$

(B) $\cos\alpha = \frac{4}{5}$

(C) $\sin\beta = \frac{3}{5}$

(D) $\cos\beta = \frac{3}{5}$

5. Seven cards have different symbols as shown below.

How many different ways can these cards be arranged in a straight line?

(A) $7 + 6 + 5 + 4 + 3 + 2 + 1$

(B) $7 + 7 + 7 + 7 + 7 + 7 + 7$

(C) $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

(D) $7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7$

6. Which expression is equivalent to $2a(a + 1) - 3(a - 3)$?

(A) $2a^2 + a - 9$

(B) $2a^2 - a + 9$

(C) $2a^2 - a - 9$

(D) $5a - 2$

7. Crafty Graphics purchases a laptop computer for $1200. If the value of this laptop depreciates at a rate of 2% per month, calculate the value of the laptop computer after 1.5 years.

(A) $795.06

(B) $834.16

(C) $1164.18

(D) $1176.00

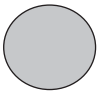
8. Shay works in a local clothing outlet on weekdays after school for 2 hours, Monday to Friday. She also works on Saturday for 6 hours at time-and-a-half.

Day	Mon	Tue	Wed	Thu	Fri	Sat
Hours	2	2	2	2	2	6

If her normal rate of pay is \$12.00 per hour, how much does she earn in a normal week?

(A) \$126
(B) \$168
(C) \$192
(D) \$228

9. A circle has an area of 45 cm^2. What is the radius of the circle?

Area shaded is 45 cm^2 

(A) $\frac{45}{\pi}$

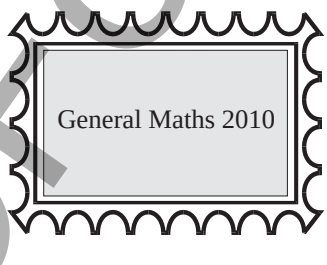
(B) $\frac{\sqrt{45}}{\pi}$

(C) $\frac{\sqrt{45}}{2\pi}$

(D) $\sqrt{\frac{45}{\pi}}$

10. A stamp measures 5 cm by 3 cm to the nearest centimetre.

What is the minimum possible area of the stamp in (cm^2)?



(A) 8.00
(B) 11.25
(C) 13.50
(D) 15.00

11. Twelve players try out for a basketball team. There are just seven people selected for the team. How many possible teams can be selected?

(A) 7
(B) 12
(C) 84
(D) 792

12. Lee and Sue's test results are displayed in the table below.

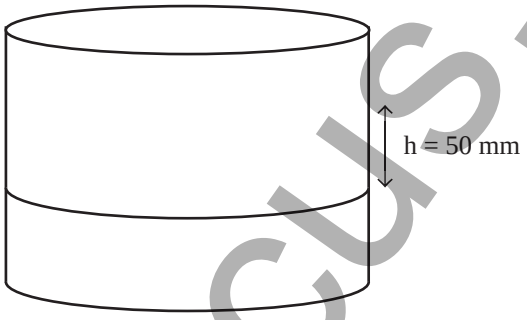
	General Maths $\bar{x} = 55$, $sd = 12$	Senior Science $\bar{x} = 75$, $sd = 10$
Lee	61	70
Sue	49	65

Which of the following is the better score?

(A) Lee, Maths
(B) Lee, Science
(C) Sue, Maths
(D) Sue, Science

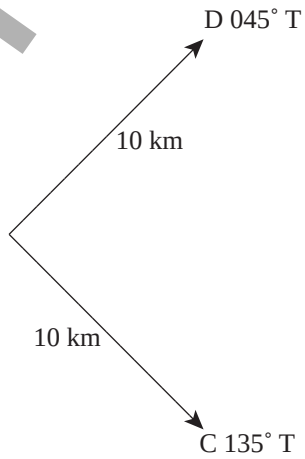
13. A cylindrical tank has a diameter of 2.5 metres. After a thunderstorm it was noted that the water level rose by 50 mm.

How much **extra** water is now in the tank? (nearest 100 litres)



(A) 200
(B) 1000
(C) 3900
(D) 9800

14. What is the bearing of *C* from *D* in the diagram below?



(A) 045° T
(B) 090° T
(C) 135° T
(D) 180° T

15. The income tax rates below were applied in the 2008 – 2009 financial year.

Taxable income	Tax on this income
\$1 – \$6000	nil
\$6001 – \$34 000	15 ¢ for each \$1 over \$6000
\$34 001 – \$80 000	\$4200 plus 30 ¢ for each \$1 over \$34 000
\$80 001 – \$180 000	\$18 000 plus 40 ¢ for each \$1 over \$80 000
\$180 001 and over	\$58 000 plus 45 ¢ for each \$1 over \$180 000

Helen earned a gross income of \$82 000 and had allowable deductions to the value of \$2500.
Calculate the income tax payable for Helen's taxable income.

(A) \$17 850
(B) \$18 600
(C) \$18 800
(D) \$32 800

16. The results from a Trial Maths examination are normally distributed with a mean of 65.
If 95% of students scored marks between 39 and 91, what percentage of students scored less than 52?

(A) 13
(B) 16
(C) 52
(D) 68

17. In the formula for the Surface Area of a Cylinder, $S = 2\pi r^2 + 2\pi rh$, the value of h is given by:

(A) $h = \dfrac{S - 2\pi r^2}{2\pi r}$

(B) $h = S - 2\pi r^2 - 2\pi r$

(C) $h = S - \dfrac{2\pi r^2}{2\pi r}$

(D) $h = \dfrac{S}{2\pi r} - 2\pi r^2$

18. The stopping distance (d) of a car varies directly to the square of the speed (v) of the car. The stopping distance of a car travelling at 90 km/h is 45 metres.
Which of the following represents the correct relationship between d (metres) and v (km/h)?

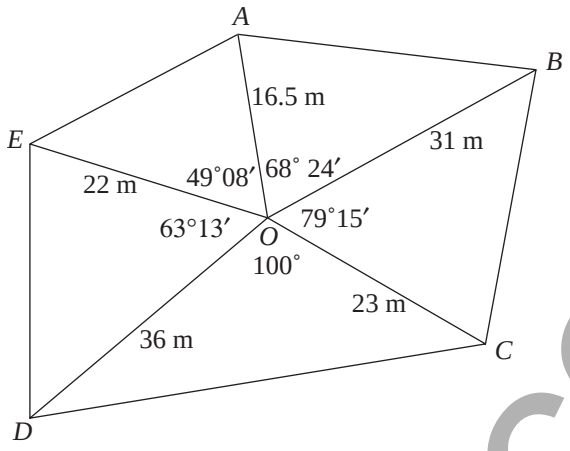
(A) $2d = 45v^2$

(B) $45d = 2v^2$

(C) $d = 180v^2$

(D) $180d = v^2$

19. Calculate the straight-line distance between the corner points *A* and *C* in the radial survey below.



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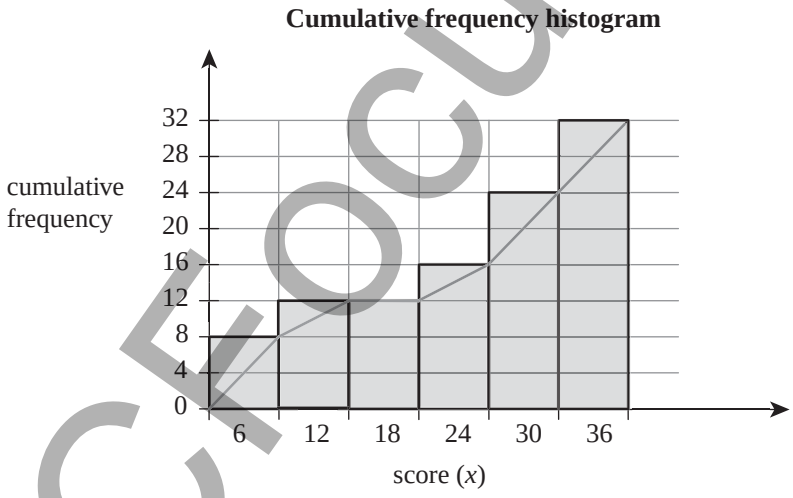
(A) 26.09m
(B) 31.55m
(C) 37.98m
(D) 39.50m

20. Calculate the interquartile range for the data presented in the cumulative histogram below.



(A) 24
(B) 28
(C) 32
(D) 36

21. $G = \dfrac{\sqrt{3m^2 + 2m - 1}}{(5m - 3)^3}$. Calculate the value of *G* accurate to 4 significant figures when $m = 3$.

(A) 0.003274
(B) 0.0033
(C) 0.1048
(D) 0.1361

22. The local Riverton Football Club needs to accumulate $150 000 to build a new clubhouse and training facilities in 3 years' time. To achieve this, the club sets up a sinking fund and makes monthly contributions into an investment account that yields 6% p.a. compounded monthly.

Calculate the amount the Riverton Football Club contributes monthly into the fund.

(A) $1759.98
(B) $2281.65
(C) $3813.29
(D) $4563.29

End of Section I

Section II

78 marks
Attempt Questions 23–28.
Allow about 2 hours for this section.

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

All necessary working should be shown in every question.

Marks

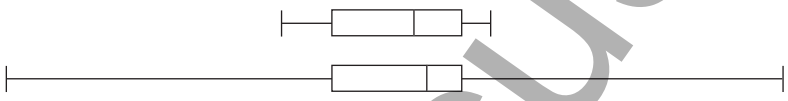
Question 23 (13 marks)

(a) The following test scores were collected after half-yearly examinations were completed.

Music	58	72	69	67	60	63	70	66	61	64
Economics	42	67	70	54	94	66	69	62	74	80

(i) Calculate the mean and standard deviation for the Music scores. **2**

(ii) A box-and-whisker plot for both the Music and Economics scores was constructed.



Compare and contrast the Music and Economics test scores using the range and interquartile range. **2**

(b) The average and standard deviation for a General Mathematics test were 72 and 10 respectively.

(i) What score is 1.5 standard deviations below the mean? **1**

(ii) Amy scored 93. What was her Z-score for this test? **1**

(iii) If Dylan's Z-score was –2.4, what mark did he score in the test? **2**

(c) The radio announcer stated that 'there was a correlation between the amount of student study and the number of hours partying!'

What did the announcer mean by correlation? **1**

(d) Mali buys two tickets for $1.00 each in a raffle. There are 500 tickets in the raffle and two prizes. First prize is $250, and Second prize is $100.

(i) Draw a tree diagram to show the possible prize outcomes.

What chance has Mali of winning Second prize? **2**

(ii) What is Mali's financial expectation? **2**

End of Question 23

Question 24 (13 marks) Use a SEPARATE writing booklet.

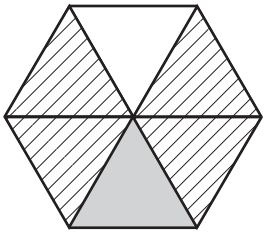
(a) In a horse race there are 24 horses.

(i) Is it true to say that a particular horse has a 1-in-24 chance of winning the race? **1**

Explain your answer.

(ii) How many different possibilities are there for horses finishing first and second? **1**

(b) The hexagonal spinner below is spun twice.



(i) What is the probability that it will land on a striped section on the first spin? **1**

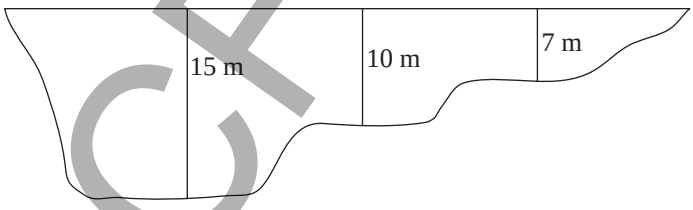
(ii) What is the probability that it will land on a striped and then a white section on consecutive spins? **1**

(iii) What is the probability that it will land on the same colour on each spin? **2**

(iv) In a game of 'Spinner', players spin until two consecutive spins produce a different colour.

What is the probability that the first player will need to spin five times before the second player gets a turn? **2**

(c) The following cross-section is of the Wilson River. Depth measurements were obtained every 10 metres.



(i) How wide is the Wilson River at this point? **1**

(ii) Use Simpson's Rule to calculate the cross-sectional area of the Wilson River. **2**

(iii) If water in the Wilson River is flowing at a rate of 5 km/h, calculate the volume of water (in litres) that flows past this point every 10 minutes. **2**

End of Question 24

Question 25 (13 marks) Use a SEPARATE writing booklet.

(a) A rowing team raced over 2000 metres with an average stroke rate of 36 strokes per minute. The race took this team 5 minutes and 20 seconds to complete.

(i) How many strokes did the team make to complete the race? **1**

(ii) How far did the team travel with each stroke? **1**

(iii) What was the average speed in km/h of the team for this 2000 m event? **2**

(b) The light intensity (l) from a light source varies indirectly to the distance (d) squared. At a distance of 10 metres the intensity of the light source is 2 units.

(i) What is the constant of variation? **1**

(ii) What is the intensity of the light at a distance of 5 metres? **1**

(iii) How far away from the light source would you need to be for the intensity to be 1 unit? **2**

(c) A coffee retailer buys different coffees from a supplier to make their own blend. The coffee beans purchased by the retailer are:

Coffee A: \$24.00 per kilogram
Coffee B: \$36.00 per kilogram
Coffee C: \$60.00 per kilogram

The two most popular blends consist of:

Morning Blend – Coffee A: Coffee C in the ratio 2:5
Afternoon Blend – Coffee B: Coffee C in the ratio 3:2

(i) What is the cost for three kilograms of Coffee B? **1**

(ii) What is the cost of five kilograms of the Afternoon Blend? **1**

(iii) What is the cost per kilogram of the Afternoon Blend? **1**

(iv) A cup of coffee requires 7 grams of ground coffee.

How much does it cost per cup of coffee for the Afternoon Blend? **2**

End of Question 25

Marks

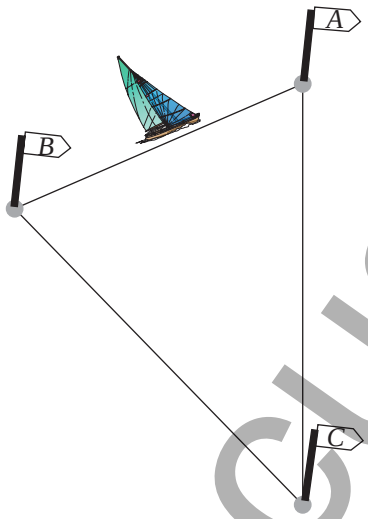
Question 26 (13 marks) Use a SEPARATE writing booklet.

(a) Alanna has been presented with two investment options for her $5000 prize money.

Option 1: Investing $5000 now into a fund that will be worth $6300 in five years.
Option 2: Depositing the $5000 into a savings account for 5 years that pays 4% p.a. interest compounded quarterly.

Use calculations to show which investment option will give Alanna the largest return at the end of 5 years. **2**

(b) A sail boat race course is shown.



(i) The ratio of each leg (the distances between the buoys *AB*, *BC* and *AC*) is 3 : 5 : 6 respectively. The course is 4.2 km long.

Calculate the distance between each of the buoys. **3**

(ii) How long does it take a boat to sail one complete lap of the course if travelling at a speed of 5 knots? (Use 1 knot = 1.852 km/h and answer accurate to the nearest minute.) **1**

(iii) Use a calculation to show whether the legs *AB* and *BC* are perpendicular to each other or not. **1**

(iv) Buoy *A* is Due North of buoy *C*. Calculate $\angle ACB$ and hence write down the bearing of buoy *B* from buoy *C*. **2**

(c) Localville (48° 15′ N, 16° 22′ E), Coordinay (48° 15′ N, 134° 22′ E) and Griddoon (22° 25′ S, 16° 22′ E) are three places located on the Earth.

(i) Calculate the difference in longitude between Localville and Coordinay. **1**

(ii) If it is 5pm on 10 August in Localville, what time and date is it in Coordinay? **1**

(iii) Calculate the distance along the Earth's surface between Localville and Griddoon. Take the radius of the Earth to be 6400 km and answer to the nearest whole km. **2**

End of Question 26

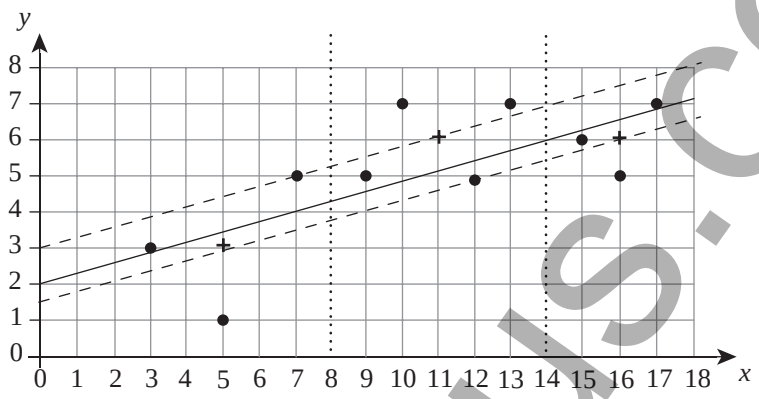
Marks

Question 27 (13 marks) Use a SEPARATE writing booklet.

(a) Rod opens an investment account the day his daughter is born. He decides to deposit $50 every month until she reaches her 21st birthday. At this time, Rod intends to close the account and give the money to his daughter.
The financial institution with which Rod chooses to open the investment account pays 8% p.a. compounded monthly.

How much will he be able to give to his daughter on her 21st birthday if each deposit is made at the end of each month? **2**

(b)



(i) Determine the equation of the solid three-median regression line. **2**

(ii) Two more scores with coordinates (7, 3) and (16, 2) are added to the existing data.

Calculate the coordinates of the new median points in the upper and lower thirds of the data. **2**

(iii) Calculate the gradient of the new three-median regression line after the two points are included in the graph. **1**

(c) A manufacturer presses eight, equal-sized circular discs with a radius of 23 cm out of one rectangular sheet of metal as shown below. The remaining unused metal is recycled and used in another part of the manufacturing process.

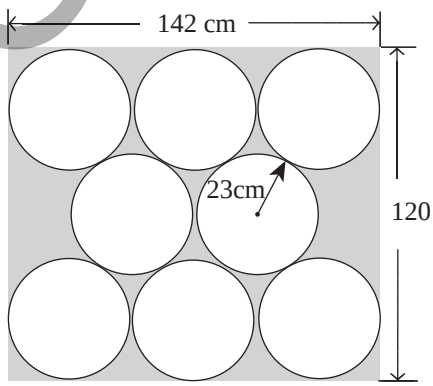


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Figure 1

Question 27 continues on page 14

Marks

Question 27 (continued)

(i) Calculate the area of metal that is recycled from the sheet in Figure 1 accurate to 2 decimal places. **2**

(ii) The supplier of the metal to this manufacturer changes the shape of the sheets to longer, narrow rectangles. The manufacturer is still able to press eight circles with radii of 23 cm from each sheet as shown in Figure 2 below.

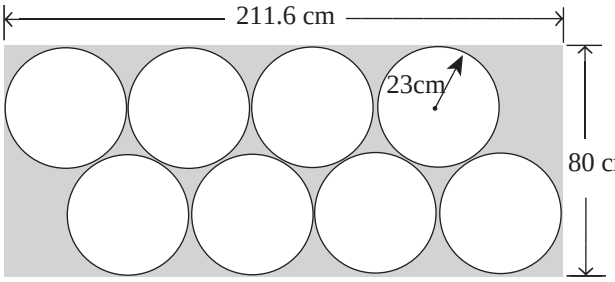

Figure 2

Calculate the area of metal that is recycled from the sheet in Figure 2 accurate to 2 decimal places. **1**

(iii) Show that –3% of the original amount of recycled metal is now recycled with the new shaped sheets. **2**

(iv) When the shape of the sheets changed, the supplier did not change the cost per sheet. Explain whether this indicates an increase or decrease in the price of each metal sheet for the manufacturer. **1**

End of Question 27

Marks

Question 28 (13 marks) Use a SEPARATE writing booklet.

(a) A guitar string manufacturer has a test machine that checks for the consistency of wire thickness for each string produced. The machine was recently checked for accuracy during 1 hour of production and the results displayed in the two-way table below.

	Machine passed the string	Machine rejected the string	TOTAL
String thickness consistent	158	3	161
String thickness not consistent	1	14	15
TOTAL	159	17	

(i) How many strings were tested incorrectly? **1**

(ii) The test machine requires a calibration service if more than 2% of the checks it performs are not correct. Calculate the percentage accuracy for the results in the table and use your calculation to state whether the machine needs a service or not. **2**

(iii) A string is randomly selected from the rejected pile during the test. Calculate the probability that the string selected had consistent thickness. **1**

(b) A new experimental projectile machine for emergency flares is tested from the top of a high structure. The path that the flare takes after projection is a parabola with equation $h = 50 + 80x - 2x^2$, where h represents the height of the flare (in metres) above the ground and x the horizontal distance (in metres), away from the base of the structure.

(i) Using this formula, copy and complete the table below in your writing booklet. **2**

x	0	5	10	15	20	25
h						

(ii) Graph the path of the flare in your writing booklet, showing the height of the flare (h) in metres above ground for various horizontal distances (x) from the base of the structure. **2**

(iii) What is the height of the structure from which the flare is tested? **1**

Question 28 continues on page 16

Marks

Question 28 (continued)

Figure 3 below is a partial cross-section of the Earth. The maximum height of the tested flare (F) above the Earth's surface (S) is given by h. The radius of the Earth is 6400 km.

(iv) Calculate the straight line distance in kilometres between the flare (F) and the point (G) on the ocean if FG and OG are perpendicular to each other. Answer accurate to 1 decimal place. **1**

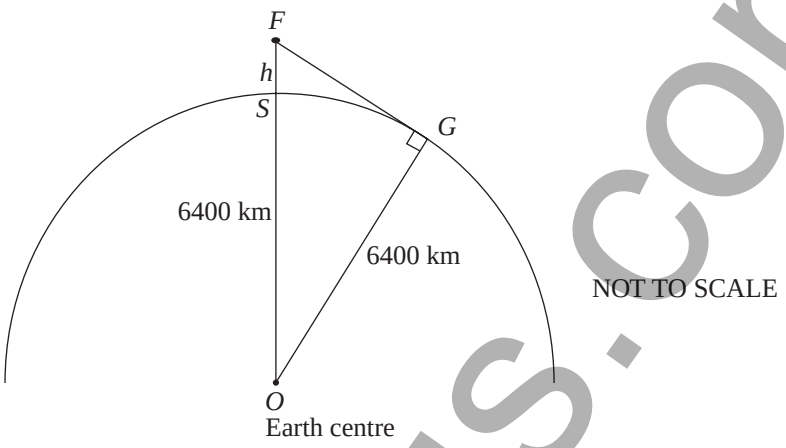

Figure 3

(v) If the angle at the centre of the Earth is 0°56′, calculate the distance between the two points S and G on the Earth's Surface to the nearest whole km. **1**

(vi) Use calculations to determine if a ship currently at G with a maximum speed of 24 km/h would reach a ship in trouble at S within 4 hours and 30 minutes. **2**

End of paper

Formulae Sheet

Area of an annulus

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

R = radius of outer circle

r = radius of inner circle

Area of an ellipse

$A = \pi ab$

a = length of semi-major axis

b = length of semi-minor axis

Area of a sector

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

θ = number of degrees in central angle

Arc length of a circle

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

θ = number of degrees in central angle

Simpson's rule for area approximation

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

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

Surface area

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

Closed cylinder: $A = 2\pi rh + 2\pi r^2$

r = radius

h = perpendicular height

Volume

Cone: $V = \frac{1}{3}\pi r^2 h$

Cylinder: $V = \pi r^2 h$

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

Sphere: $V = \frac{4}{3}\pi r^3$

r = radius

h = perpendicular height

A = area of base

Sine rule

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

Area of a triangle

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

Cosine rule

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

or

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

Simple interest

$I = Prn$

P = initial quantity
r = percentage interest rate per period, expressed as a decimal
n = number of periods

Compound interest

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

A = final balance
P = initial quantity
n = number of compounding periods
r = percentage interest rate per compounding period, expressed as a decimal

Future value (*A*) of an annuity

$$A = M\left\{\frac{(1 + r)^n - 1}{r}\right\}$$

M = contribution per period, paid at the end of the period

Present value (*N*) of an annuity

$$N = M\left\{\frac{(1 + r)^n - 1}{r(1 + r)^n}\right\}$$

or

$$N = \frac{A}{(1 + r)^n}$$

Straight-line formula for depreciation

$S = V_0 - Dn$

S = salvage value of asset after n periods
V_0 = purchase price of the asset
D = amount of depreciation apportioned per period
n = number of periods

Declining balance formula for depreciation

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

S = salvage value of asset after n periods
r = percentage interest rate per period, expressed as a decimal

Mean of a sample

$$\bar{x} = \frac{\Sigma x}{n}$$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$\bar{x}$ = mean
x = individual score
n = number of scores
f = frequency

Formula for a *z*-score

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

s = standard deviation

Gradient of a straight line

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

Gradient–intercept form of straight line

$y = mx + b$

m = gradient
b = y-intercept

Probability of an event

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

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

