

Name:	Level/Subject: 4048 Sec 4 E-Math
Material: February Practice Questions 2022	Centre: Overmugged

Instructions

- Answer all questions
- If working is needed for any question it must be shown with the answer
- Omission of essential working will result in loss of marks
- You are expected to use a scientific calculator to evaluate explicit numerical expressions
- If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures
- Give answers in degrees to one decimal place
- For π , use either your calculator value of 3.142, unless the question requires the answer in terms of π
- A copy of the formula list is provided for you on the next page

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Question Source

All questions are sourced and selected based on the known abilities of students sitting for the 'O' Level E-Math Examination. All questions compiled here are from **2009 - 2021 School Mid-Year / Prelim Papers**. Questions are categorised into the various topics and range in varying difficulties. If questions are sourced from respective sources, credit will be given when appropriate.

How to read:

[S4 ABCSS P1/2011 PRELIM Qn 1]

Secondary 4, ABC Secondary School, Paper 1, 2011, Prelim, Question 1

Prepared by: **Kaiwen** :)

This question paper consists of 48 printed pages including the cover page

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List of Mathematical Formulae*Compound interest*

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

1 Numbers & their Operations

1. (a) Simplify [2]

$$\frac{3^{n+2} - 3^n}{9(3^{n+1}) - 3^{n+2}}$$

- (b) Find the value of b in [2]

$$4^{2b-1} \times 8^{1-b} = 32^{b-2}$$

Credit: **S4 DMSS P1/2009 PRELIM Qn 2**

2. The radius of a strand of cylindrical hair is 500 picometres
- (a) Express 500 picometres in metres, giving your answer in standard form [1]
- (b) Given that the volume of the strand of hair is $3.2 \times 10^{-20} \text{ m}^3$. Assuming that the strand of hair has a uniform cross-sectional area, find its length [1]

Credit: **S4 MGS P1/2010 PRELIM Qn 2**

3. (a) Express 2520 as the product of its prime factors [1]
- (b) Given that $2520k$ is a perfect square, write down the smallest possible integer value of k [1]
- (c) Find the smallest positive integer value of n for which $2520n$ is a multiple of 65 [1]

Credit: **S4 CHS P1/2011 PRELIM Qn 6**

4. (a) (i) Use your calculator to evaluate the following. Write down all the figures shown on your calculator display [1]

$$\sqrt{\frac{8.01 \times 25.01}{1.999}}$$

- (ii) Correct your answer in part (a) to 3 significant figures [1]
- (b) Consider the following numbers:

$$\sqrt{65} \quad -3.14 \quad \pi \quad 0.4\dot{5} \quad (-0.2)^3 \quad (-3)^2 \quad \sqrt[3]{-64} \quad 3\frac{1}{7}$$

Write down the

- (i) positive numbers [1]
- (ii) irrational numbers [1]

Credit: **S4 DSS P1/2011 PRELIM Qn 1 & 2**

5. Given the following three terms:

$$x^2 \times y \times z \quad w \times x \times y \times z^3 \quad w^2 \times x^3 \times y^3 \times z^2$$

- (a) Find the highest common factor (HCF) [1]
- (b) Find the lowest common multiple (LCM) of the three terms [1]
- (c) The product of the HCF and the LCM is 6534000. Given that $x = 2$, $y = 5$ and $w = 11$, find the value of z [2]

Credit: **S4 PLMGS P1/2011 PRELIM Qn 18**

2 Ratio & Proportion

1. Mr Tan's monthly savings (S) is directly proportional to the square root of his monthly income (I). His income in January and February 2011 is \$3600 and \$2500 respectively. His savings in January is \$80 more than in February. Find the amount he saved in January 2011 [3]

Credit: **S4 AHS P1/2011 PRELIM Qn 13**

2. (a) 6 men working 8 hours a day, can build a cupboard in 2 days. In how many more days will 4 men, working 3 hours a day at the same rate, complete the same job [2]
- (b) y is inversely proportional to the square of x . Find the percentage decrease in y when x increases by 300% [2]

Credit: **S4 CHIJ SJC P1/2011 PRELIM Qn 11**

3. A map is drawn using a scale of $1 : n$. On this map, a length of 5 cm represents an actual distance of 2 km
- (a) Find n [1]
- (b) Calculate the area on the map, in cm^2 , which represents an actual area of 3 km^2 [2]

Credit: **S4 TKGS P1/2011 PRELIM Qn 5**

4. The intensity, I , of a given light source is inversely proportional to the square of the distance, d . For a given distance of d cm, intensity is 120 units. Find the new value of I when d is halved [2]

Credit: **S4 BWSS P1/2015 PRELIM Qn 10**

3 Percentage

1. (a) In June 2011, the price of a car was \$56000. Over the next 2 months, the price increased by 25% and then decreased by 15%. Mr Tan a potential car owner, said that the overall increase in the price of the car was 10%. Do you agree with Mr Tan? Justify your answer [2]
- (b) Mr Goh bought a sports car from a car dealer. He made a down payment of 40% of the selling price and paid the remaining amount by taking up a monthly instalment payment scheme jointly offered by Bank A and Bank B.

The table shows for **50% of the sum borrowed**

From	Payment Scheme
Bank A	Simple interest of 3% per annum of 3 years
Bank B	Compound interest of 2.4% per annum compounded monthly for 3 years

Given that Mr Goh made a down payment of S\$41832

- (i) Write down the loan amount taken at each bank [2]
- (ii) Calculate his monthly instalment payable to Bank A and Bank B respectively [4]

After 3 years, Mr Goh sold his sport car to a swiss friend at a loss of 15% of the price he paid for it. The price he paid for includes the interest paid to the banks

- (iii) Find his selling price [2]
- (iv) Given that he received 56900 CHF (Swiss Franc), calculate the rate of exchange, in Swiss Franc (CHF) to one Singapore dollar (S\$), giving your answer correct to the nearest cent [1]

Credit: **S4 TKGS P2/2011 PRELIM Qn 6**

2. Charlie invested \$25000 into a business which gave a guaranteed return at 4% per annum compounded every quarterly. Find the total return earned after 3 years, giving your answers to the nearest cents [2]

Credit: **S4 ACS(B) P1/2015 PRELIM Qn 2**

3. Ivan invested some money in a saving account for 2 years. The rate of compound interest was fixed at 10% per annum compounded half-yearly. At the end of the 2 years, there was \$9724.05 in his account. How much did Ivan invest the account? [2]

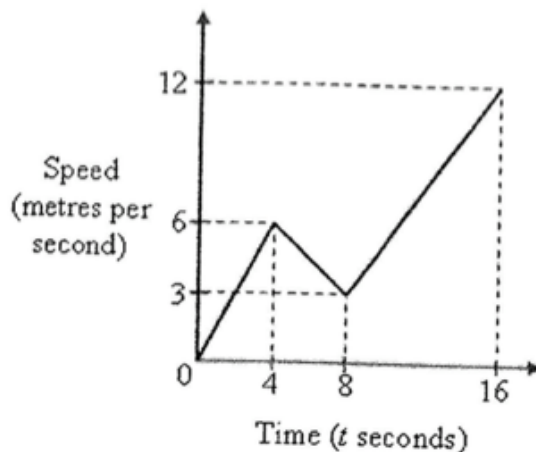
Credit: **S4 BSS P1/2015 PRELIM Qn 15**

4. (a) Lenny bought a brand new car at a selling price of \$109000. He paid 40% of the selling price in cash and took a 5 year loan for the rest of the amount. If the bank charges 2.8% of simple interest per annum for the loan, calculate
- (i) the total interest payable [2]
 - (ii) the amount Lenny has to pay per month for the loan [2]
- (b) Lenny's use car uses fuel at the average rate of 9.5 litres per 100 km driven. In an average year, Lenny drives 15000 km. The retail price of fuel is \$2.25 per litres and Lenny has a loyalty card that gives him 10% discount off the retail price. Assuming the price of fuel remains the same, work out the amount Lenny would expect to spend on fuel in one year, correct to the nearest dollar [2]
- (c) The original value of the car is its selling price of \$109000. For each of the first five years, the value of the car decreases by 13% of its value at the start of every year. After 3 years, Lenny decides to sell the car. Calculate the overall percentage reduction in the value of the car compared with its original value, giving your answer to 2 decimal places [3]

Credit: **S4 CTSS P2/2011 PRELIM Qn 2**

4 Rate & Speed

1. The diagram below shows the speed-time graph of an object

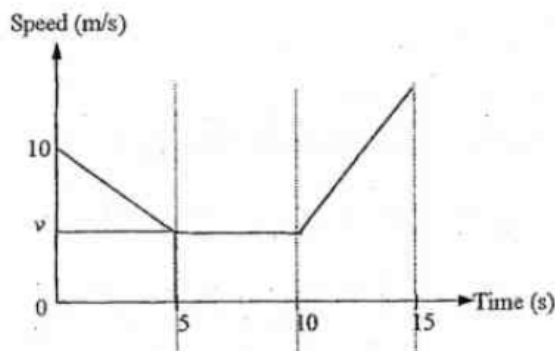


- (a) Find the acceleration of the object when $t = 12$ [1]
 (b) Find the total distance covered in 16 seconds [2]
 (c) Hence, or otherwise, calculate the average speed of the object [1]

Credit: **S4 AMSS P1/2011 PRELIM Qn 17**

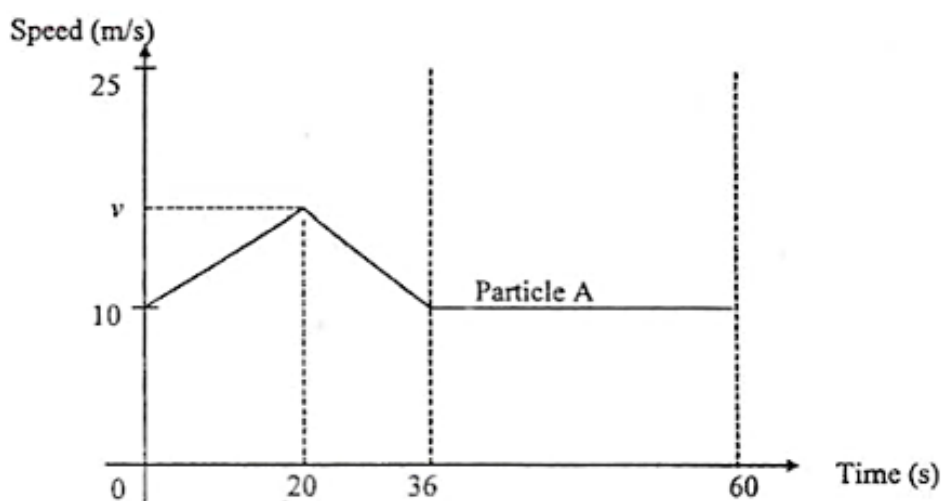
2. The diagram shows the speed-time graph of a particle over a period of 15 seconds. The particle uniformly decelerated from 10 m/s to v m/s in 5 seconds. It then maintains at this speed for the next 5 seconds and accelerates uniformly at 2 m/s^2 for another 5 seconds. The distance travelled in the first 5 seconds is 35 m

- (a) Find the value of v [1]
 (b) Find the speed of the particle after 15 seconds [1]
 (c) Complete the corresponding distance-time graph [3]



Credit: **S4 CTSS P1/2015 PRELIM Qn 24**

3. (a) A train started its journey from Singapore at 1526 and arrived at Gemas station, Malaysia at 2014 on the same day
- (i) What was the time taken for the journey from Singapore to Gemas station? [1]
 - (ii) Another train leaves Gemas station for Singapore at 2218 on Wednesday. If the distance between the two stations is 220 km and the average speed of the passenger train is 80 km/h, find the arrival time of the train in Singapore [2]
- (b) The diagram shows the speed time graph of a particle A during a period of 60 seconds. The particle A starts from a speed of 10 m/s and accelerates uniformly until it reaches a maximum speed of v m/s. It then decelerates and reaches 10 m/s at 36 seconds and continues to travel at this constant speed. The distance travelled by this particle A in the first 20 seconds is 280 m. Calculate
- (i) the maximum speed, v , of the particle A [1]
 - (ii) the retardation of the particle A during the motion [1]

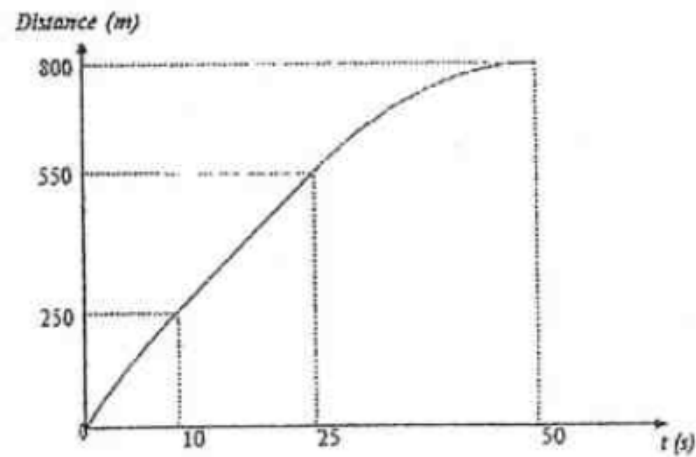


Another particle B starts from rest 20 seconds later, and accelerates uniformly until it reaches a maximum speed of 25 m/s at 36 seconds. It then continues at this maximum speed

- (iii) On the same axes above, draw the graph to represent the journey of particle B [1]
- (iv) Calculate
 - (a) the acceleration of particle B during the first 10 seconds of its journey [1]
 - (b) the distance between particle A and particle B at 60 seconds [2]

Credit: S4 MGS P1/2011 PRELIM Qn 7 & 22

4. The diagram shows the distance-time graph for the first 50 seconds of a car journey. The car moves at a constant speed from $t = 10$ s to $t = 25$ s and comes to rest after 50 seconds



- (a) Find the speed of the car when $t = 15$ [1]
- (b) Given that the car moves with a constant deceleration for the last 25 seconds, find its deceleration for the last 25 seconds [1]
- (c) The car starts at 30 m/s and decelerates uniformly for the first 10 seconds. Sketch the speed-time graph of the car's journey [1]

Credit: **S4 CGS P1/2015 PRELIM Qn 20**

5 Algebraic Expressions & Formulae

1. (a) Factorise completely [2]

$$3(9a^2 - 4b^2) - 2(6a^2 + ab - 2b^2)$$

- (b) Find the exact value of [1]

$$200\,000\,004^2 - 200\,000\,002^2$$

- (c) Given that [2]

$$4x^2 + 9y^2 = 12xy$$

find the value of

$$\frac{4x}{9y}$$

Credit: **S4 GESS P1/2009 PRELIM Qn 15**

2. The first four terms of a sequence are given by

$$8, \quad 64, \quad 216, \quad 512, \quad \dots$$

- (a) Write down the next term of the sequence [1]

- (b) Find an expression, in terms of n , for the n th term of a sequence [1]

- (c) In another sequence, the first four terms are [1]

$$10, \quad 66, \quad 218, \quad 514, \quad \dots$$

By comparing this sequence with your answer in (b), write down an expression, in terms of n , for the n th term of the sequence

Credit: **S4 VS P1/2009 PRELIM Qn 6**

3. (a) (i) Make x the subject of the formula [3]

$$y = \frac{x^2}{2x^2 - w}$$

- (ii) Find the value(s) of x when $y = 3$ and $w = 17$, leaving your answer(s) in 3 significant figures where necessary [2]

- (b) Simplify the following [3]

$$\frac{m^3 - n^2m^3}{(mn)^2 - m^2}$$

- (c) Solve the simultaneous equations [3]

$$\begin{aligned} \frac{1}{2}y + 2x &= 36 \\ 2x - y + 12 &= 0 \end{aligned}$$

Credit: **S4 ZHSS P1/2011 PRELIM Qn 5 & 6**

4. (a) In the following sequence of equations

$$(1 \times 2) - 2 = 0$$

$$(2 \times 3) - 4 = 2$$

$$(3 \times 4) - 6 = 6$$

...

$$(m \times 12) - p = t$$

...

$$(n \times y) - z = r$$

- (i) State the 4th equation [1]
(ii) Find the values of m , p and t [3]
(iii) Express r in terms of n [2]
(b) Determine if $r = 196$ can be the result of an equation in the sequence [2]

Credit: **S4 CCHS(M) P2/2015 PRELIM Qn 2**

6 Functions & Graphs

1. Answer the whole of this question on a sheet of graph paper

The variables x and y are connected by the equation

$$y = -5 + \frac{3}{2^x}$$

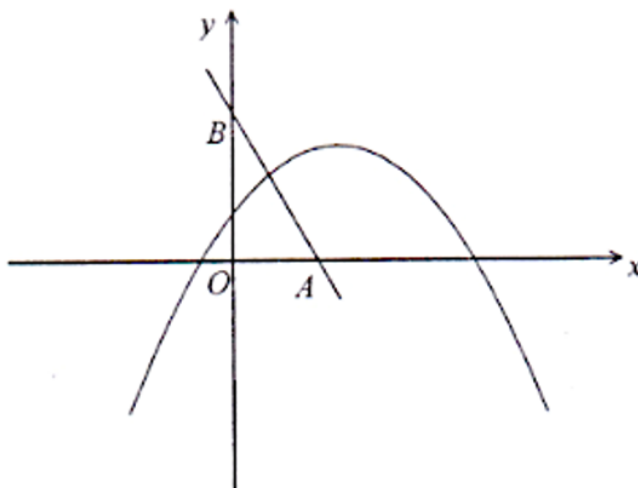
Some corresponding values of x and y , correct to 2 decimal places, are given in the following table

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	p	3.49	1.00	-0.76	-2.00	-2.88	q	-3.94	-4.25

- (a) Find the values of p and q [1]
- (b) Using a scale of 4 cm to 1 unit on the x -axis and 2 cm to 1 unit on the y -axis, draw the graph of $y = -5 + \frac{3}{2^x}$, for $-2 \leq x \leq 2$ [3]
- (c) Use your graph to solve the equations
- (i) $\frac{3}{2^x} = 5$ [1]
- (ii) $\frac{3}{2^x} + 2x - 6 = 0$ [3]
- (d) Find the gradient of the curve at the point $x = -1$ [2]

Credit: **S4 BSS P2/2009 PRELIM Qn 9**

2. The diagram shows the line $y = -2x + 1$ and the curve $y = x(1 - x) + k$.



The line cuts the x -axis at A and y -axis at B

- (a) Calculate the length of AB , leaving your answer in the form $\frac{\sqrt{a}}{b}$ [2]
- (b) Given that the curve passes through the point $\left(\frac{1}{4}, \frac{1}{2}\right)$, find the value of k [1]
- (c) Find the coordinates of the maximum point of the curve [2]

Credit: **S4 SCGS P1/2010 PRELIM Qn 21**

3. (a) (i) Express $x^2 + 2x - 6$ in the form $k(x + a)^2 + b$ [1]
 (ii) Hence, sketch the graph of $y = x^2 + 2x - 6$, indicating clearly the coordinates of the x -intercepts and y -intercept, if any [3]
- (b) Sketch the graphs of
- (i) $y = x^3 + 1$ [2]
 (ii) $y = \frac{2}{x}$ [1]

Credit: **S4 DHS P1/2011 PRELIM Qn 18**

4. **Answer the whole of this question on a sheet of graph paper**

The variables x and y are connected by the equation

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

Corresponding values of x and y , corrected to 1 decimal place where necessary, are given in the following table

x	-1.5	-1.3	-1	-0.5	0	0.5	1	2	2.5	3	3.3	3.5
y	5.1	3.6	p	0.4	0	0.3	1	2	1.6	0	-1.6	-3.1

- (a) Calculate the value of p [1]
 (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-1.5 \leq x \leq 3.5$. [3]
 Using a scale of 2 cm to represent 1 unit, draw a vertical y -axis for $-4 \leq y \leq 6$. Draw the graph of the following, for $-1.5 \leq x \leq 3.5$

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

- (c) Use your graph to write down the range of values of x for which the gradient is positive [1]
 (d) Use your graph to find the value of x for which [1]

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

- (e) By drawing a tangent, find the gradient of the curve at $x = 2.5$ [2]
 (f) (i) On the same axes, draw the graph of the straight line $x + y = 1$ [1]
 (ii) Hence, write down the three possible solutions to the equation [1]

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

Credit: **S4 MGS P2/2011 PRELIM Qn 9**

7 Equations & Inequalities

1. Given that

$$-3 \leq x \leq -1 \quad 2 \leq y \leq 5$$

find the

(a) the largest possible value of $\frac{y}{x}$ [1]

(b) the smallest possible value of $\frac{x^2 + y^2}{y}$ [1]

Credit: **S4 VS P1/2011 PRELIM Qn 6**

2. Solve the equations

(a) $5x = 10x^2$ [2]

(b) $(y^2 + 1)(y^2 - 1) = 0$ [2]

Credit: **S4 ANDSS P1/2015 PRELIM Qn 13**

3. (a) Solve the inequality [2]

$$3x + 10 \leq \frac{2}{3}(2x + 25)$$

- (b) Given that

$$R = \frac{3}{t} - \frac{2t}{s}$$

(i) find R when $t = -5$ and $s = 3$ [1]

(ii) express s in terms of R and t [2]

(c) Simplify [2]

$$\frac{4p^2 - 36}{5p^2 + 8p - 21}$$

(d) Solve the equation [3]

$$\frac{y+2}{4} = \frac{8}{y-2}$$

Credit: **S4 BSS P2/2015 PRELIM Qn 1**

4. (a) Solve the equation

$$1 + \frac{3}{4x - 13} = \frac{2}{5}$$

[2]

- (b) The relationship between p and q can be expressed as

$$\frac{2p + 3q}{p + q} = 5$$

[2]

Find the value of

$$\frac{2p}{q}$$

- (c) Find all the integer values of x that satisfy the inequality

$$-1 < \frac{2(4 - 5x)}{3} < 8$$

[3]

Credit: **S4 CCHS(M) P1/2015 PRELIM Qn 6 & 7**

8 Set Language & Notation

1. The universal set is the set of integers from 1 to 12, both inclusive. The sets P , Q and R are defined as

$$P = \{p : p \text{ is a multiple of } 4\}$$

$$Q = \{q : q \text{ is a prime number}\}$$

$$R = \{r : r \text{ is an odd number}\}$$

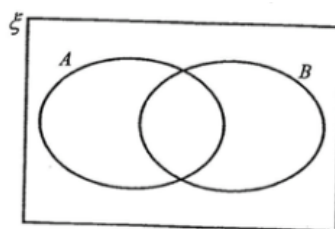
- (a) List the elements of the set $Q \cup R$ [2]
 (b) Write down $n(P \cap Q)$ [1]
 (c) Describe, as simply as possible, in words, the elements of the set $P \cap R'$ [1]
 (d) Illustrate the relationship of P , Q and R in a Venn diagram and indicate the elements in each region clearly. Shade the region representing the set [2]

$$P \cup (Q \cap R')$$

Credit: **S4 CGSS P2/2010 PRELIM Qn 3**

2. (a) On the Venn Diagram shown below, shade the set [1]

$$(A \cap B) \cup (A \cup B)'$$



- (b) Given that

$$\mathcal{E} = \{(x, y) : x \text{ and } y \text{ are real numbers}\}$$

$$P = \{(x, y) : 4y - 3x - 5 = 3\}$$

$$Q = \{(x, y) : y = ax + b\}$$

Given that

$$P \cap Q = \emptyset \quad b \neq n \quad a, b, n \in \mathbb{R}$$

Write down the value of

- (i) a [1]
 (ii) n [1]

Credit: **S4 CGS P1/2011 PRELIM Qn 10**

3. A universal set \mathcal{E} and its subset A , B and C are given by

$$\mathcal{E} = \{x : x \text{ is an integer for } 2 \leq x \leq 8\}$$

$$A = \{x : x \text{ is a factor of } 40\}$$

$$B = \{x : x^2 < 30\}$$

$$C = \{x : x \text{ is a positive integer and } 2x - 1 \leq 7\}$$

- (a) Find

(i) B

[1]

(ii) C

[1]

(iii) $A' \cap B$

[1]

- (b) State the value of $n(B \cup C)$

[1]

Credit: **S4 NASS P2/2011 PRELIM Qn 6(a) & (b)**

4. Given that

$$\mathcal{E} = \{x : x \text{ is a positive integer and } x \leq 14\}$$

$$A = \{x : x \text{ is an odd integer and } 3x + 5 > 13\}$$

$$B = \{x : x \text{ is a factor of } 28\}$$

- (a) Find the following

(i) $A \cup B$

[1]

(ii) $n(A \cap B')$

[2]

- (b) With the help of a Venn diagram, list out the elements illustrating the sets \mathcal{E} , A and B

Credit: **S4 ACS(B) P2/2015 PRELIM Qn 1**

9 Matrices

1. The average numbers of passengers travelling from Ang Mo Kio to three towns B , C and D each day during the morning peak hour from Monday to Friday are given below

	B	C	D
Number of Bus passengers	350	250	420
Number of MRT passengers	520	460	610

The information may be represented by the matrix

$$N = \begin{pmatrix} 350 & 250 & 420 \\ 520 & 460 & 610 \end{pmatrix}$$

On Saturday during the morning peak hour, there are 100 bus passengers less and 200 MRT passengers less to each town

- (a) Represent by a matrix S , the number of bus passengers and MRT passengers to each town during the peak hour on Saturday [1]

- (b) Evaluate [1]

$$P = 5N + S$$

- (c) State what the elements in the first row of P represents [1]

- (d) The distance from Ang Mo Kio to towns B , C and D are 9 km, 12 km and 15 km respectively. The bus and MRT operators charge 11 cents per km [1]

- (i) Evaluate the matrix Q [1]

$$Q = N \begin{pmatrix} 9 \\ 12 \\ 15 \end{pmatrix}$$

- (ii) State what the elements of Q represent [1]

- (iii) Using the matrix Q and another matrix, calculate the total amount collected, in dollars, by the bus and MRT operators during the weekday [2]

Credit: **S4 CHIJ SNGS P2/2010 PRELIM Qn 6**

2. The table below shows the number of packets of chocolates of 4 brands, A , B , C and D sold at 3 grocery shops

	Brand A	Brand B	Brand C	Brand D
Shop 1	5	3	1	1
Shop 2	11	6	8	5
Shop 3	8	5	4	3

A packet of chocolate costs

- \$15 for Brand A
 - \$10 for Brand B
 - \$8 for Brand C
 - \$5 for Brand D
- (a) (i) Write down a 3×4 matrix \mathbf{Q} and a 4×1 matrix \mathbf{P} that represents all the information in the table above [2]
- (ii) Evaluate \mathbf{QP} [1]
- (iii) Explain what the elements in \mathbf{QP} represent [1]
- (b) Brand A comes in packets of 18 g, Brand B in packets of 20 g, Brand C in packets of 15 g and Brand D in packets of 10 g
- (i) Write down a 4×1 matrix \mathbf{S} such that matrix \mathbf{QS} represents the total number of grams of chocolates sold by each shop [1]
- (ii) Evaluate \mathbf{QS} [1]
- (iii) Hence deduce the average cost of chocolate per gram for Shop 2 [1]

Credit: **S4 NASS P2/2011 PRELIM Qn 6(c) & (d)**

3. Han Brothers Travel has tour packages to Australia, South Korea and Japan. The table below shows the number of people who have signed up for the respective packages from January to June and from July to December

	Period 1 (From January to June)	Period 2 (From July to December)
Australia	15	29
South Korea	25	24
Japan	20	31

The information for the number of people who signed up for packages to Australia, South Korea and Japan can be represented by the matrix

$$\mathbf{P} = \begin{pmatrix} 15 & 29 \\ 25 & 24 \\ 20 & 31 \end{pmatrix}$$

- (a) Write down a 1×3 matrix \mathbf{Q} such that matrix multiplication $\mathbf{C} = \mathbf{QP}$ gives the total number of people who signed up for the tour packages in period 1 and period 2 respectively. Hence, find \mathbf{C} [2]
- (b) Given that $\mathbf{R} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$, calculate $\mathbf{D} = \mathbf{CR}$ [1]
- (c) Describe what is represented by the element(s) of \mathbf{D} [1]

Credit: **S4 CHS P1/2015 PRELIM Qn 17**

4. Abraham and Lincoln sent out some letters, postcards and greeting cards. The number of letters, postcards and greeting cards is shown in the table below

	Letters	Postcards	Greeting Cards
Abraham	4	9	2
Lincoln	7	3	3

The postage for each letter, postcard and greeting card is \$0.30, \$0.40 and \$0.50 respectively

- (a) Write down a 2×3 matrix \mathbf{P} and a column matrix \mathbf{Q} to represent the above information [2]
- (b) Evaluate the matrix $\mathbf{S} = \mathbf{PQ}$ [2]
- (c) State what the elements of \mathbf{S} represents [1]

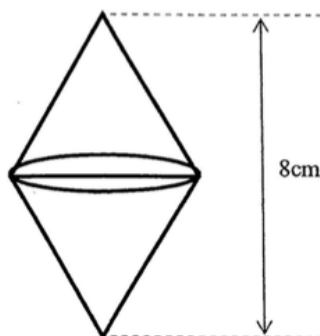
Credit: **S4 DYSS P1/2015 PRELIM Qn 20**

10 Problems in Real-World Context

1. Kenneth and Samuel visited a car showroom together and each decided to get a car of the same model. The list price of the car was \$85000
 - (a) Kenneth paid a cash deposit of 20% and took a loan on the balance at a flat rate of 1.5% per annum. He paid the loan in equal monthly instalments over 5 years. Calculate his monthly instalments [3]
 - (b) Samuel was given a VIP discount of 0.5%. He then traded in his old car and paid the balance of \$50075 in cash. How much did he trade his old car for? [2]
 - (c) How much more did Kenneth pay for the car than Samuel? Express your answer as a percentage of the list price [2]
 - (d) After buying the car, Kenneth pay for the car to a workshop in Malaysia for servicing. The exchange rate between Singapore dollars and Malaysia ringgit was S\$1=RM\$2.39
 - (i) The total cost of servicing was RM\$294, including a 5% government tax. How much did Kenneth pay in ringgit for the servicing? [1]
 - (ii) Given that Kenneth changed S\$200 initially, how much Singapore dollars did he have left? [2]

Credit: **S4 DSS P2/2011 PRELIM Qn 3**

2. The diagram shows a container made from two identical cones. The height of the container is 8 cm. [2]



Water is poured into the empty container at a constant rate. It takes 10 seconds to fill the container. Sketch the graph showing how the depth varies during the 10 seconds

Credit: **S4 NASS P1/2011 PRELIM Qn 15**

3. Victor is a sales engineer of a glassware manufacturing plant. He received a request for quotation from a customer who wishes to purchase flasks. The lower portion of the flasks can be modelled by a cone of base diameter of 8 cm. The upper portion of the cone of base diameter 2 cm has been removed as shown in Figure A. Figure B shows a complete design of the flask with a cylindrical top. The height of the flask is 11 cm

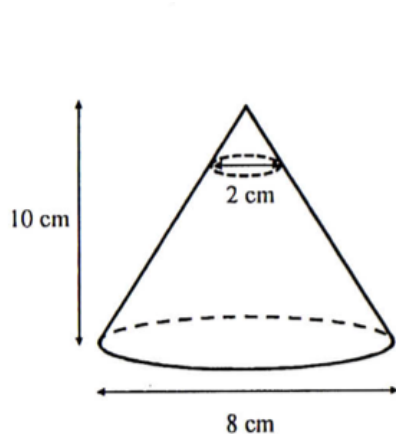


Figure A

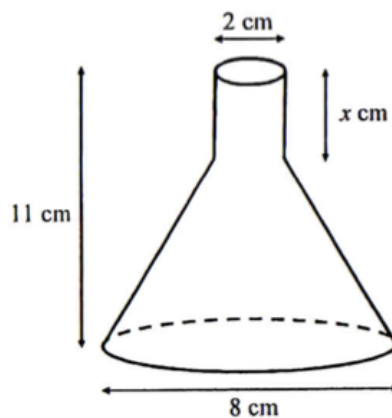


Figure B

- (a) Using the dimensions given in Figure B, show that the height of the cylindrical top, x cm, is 3.5 cm. Calculate the volume of the flask [4]

To manufacture the flask, the following costs are considered: raw materials, electricity, fuel, labour and others

Raw materials	\$2.50 per kg
Electricity	20.7 cents per kWh
Fuel	\$1.20 per litre

30 flasks required 1 kg of raw materials, 3 kWh of electricity and 2 litre of fuel to manufacture. Raw materials, electricity and fuel cost make up 75% of the total manufacturing cost of a flask while labour cost and others make up the remaining cost

- (b) Calculate the cost of manufacturing a flask that in cents, correct to one decimal place [3]

The customer wishes to order bigger flasks that is geometrically similar to the flask shown in Figure B but twice its capacity

- (c) Given that the manufacturing cost is proportional to its surface area, calculate the cost of manufacturing a big flask in cents, correct to one decimal place [3]

The average retail price of a small flask, similar in capacity found in part (i) is \$1

- (d) Suggest a sensible price of a small and big flask that Victor should quote his customer to clinch the deal. Justify your answers with reasons [3]

Credit: S4 MSHS P2/2017 PRELIM Qn 10

4. Scuba divers use diving cylinders to help them stay underwater for a long period of time. In this question, the internal compartment of a diving cylinder, as shown in **Figure 1**, can be modelled as a cylinder with a hemisphere on top, as shown in **Figure 2**

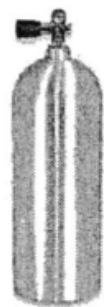


Figure 1

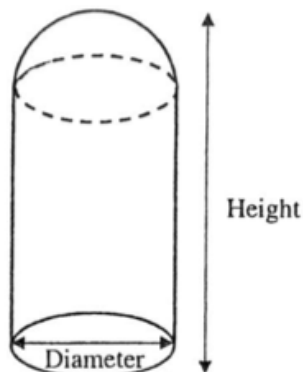


Figure 2

A diver intends to stay underwater at a depth of 20 m for 1.5 hours. He wants to determine whether a particular diving cylinder, with an internal compartment of diameter 20 cm and a height of 75 cm, is sufficient to support the dive

- (a) The volume of the diving cylinder is measured by the volume of its internal compartment. [3]
Work out the volume, in litres, of the diving cylinder
- (b) The following equation is used to calculate the volume of oxygen in the cylinder [2]

$$\text{Volume of oxygen} = \frac{(\text{Volume of cylinder}) \times (\text{Pressure in cylinder})}{(\text{Atmospheric pressure})}$$

The pressure (measured in bars) in the cylinder is 210 bars and the atmospheric pressure (measured in bars) is 1.01 bars. Find the volume, in litres, of oxygen that the diving cylinder can hold

- (c) To calculate the volume of oxygen a diver requires, the following equation is used [4]

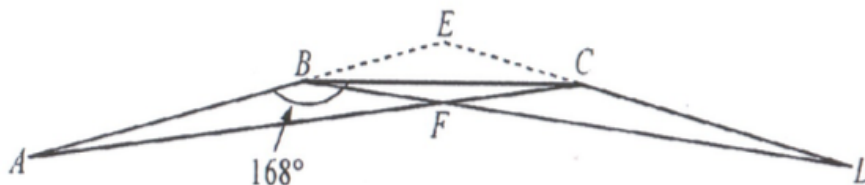
$$\text{Volume of oxygen required} = (\text{Breathing rate}) \times (\text{Duration}) \times (\text{Ambient pressure})$$

Assuming that the driver's breathing rate is 18 litres per minute and that for every 5 m underwater, the ambient pressure increases by 0.5 bars from the atmospheric pressure, determine whether the diving cylinder is sufficient to support the dive. Justify your decision with calculations

Credit: S4 VS P2/2017 MYE Qn 10

11 Angles, Triangles & Polygons

1. In the figure, AB , BC and CD are three sides of a regular polygon, $\angle ABC = 168^\circ$, AB and DC are produced to meet at E , and, AC and BD intersect at F .



Find

- (a) the number of sides of the polygon [1]
- (b) $\angle BEC$ [1]
- (c) $\angle EBF$ [2]
- (d) $\angle AFD$ [2]

Credit: **S4 HSS P1/2009 PRELIM Qn 12**

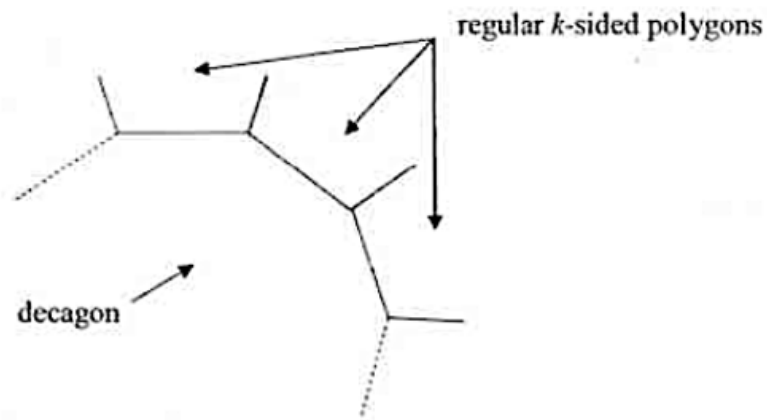
2. (a) Construct a quadrilateral $PQRS$ in which $PQ = 8$ cm, $QR = 5.5$ cm, $RS = 6.5$ cm and $\angle QPS = 50^\circ$. Diagonal $QS = 7$ cm and $\angle PQR$ is an obtuse angle [2]
- (b) Measure and write down the length of PR [1]
- (c) On the same diagram, construct and label [1]
- (i) the perpendicular bisector of PQ [1]
 - (ii) the angle bisector of $\angle PSR$ [1]

Credit: **S4 XMSS P1/2010 PRELIM Qn 13**

3. A field is in the shape of a quadrilateral $JKLM$. It is given that $JK = 115$ m, $JM = 92$ m, $KL = 100$ m, $\angle KJM = 58^\circ$ and $\angle JKL = 90^\circ$
- (a) Using a scale of 1 cm to represent 10 m, make an accurate drawing of the field [3]
Measure $\angle JML$
- (b) A signboard, S , is equidistant from JK and JM , is such that $JS = MS$. Label the point [4]
 S and measure the distance of the signboard from M

Credit: **S4 VS P2/2011 PRELIM Qn 7**

4. A number of regular k -sided polygons are placed together in a ring to form a regular decagon as shown in the diagram below

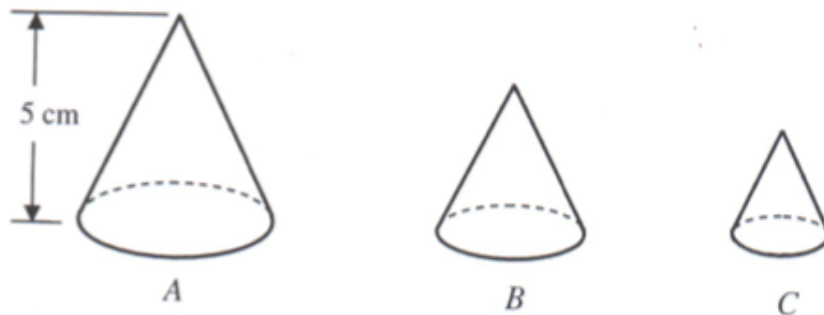


- (a) Find
- (i) the interior angle of the decagon [2]
 - (ii) the value of k [2]
- (b) If n -sided regular polygons that are placed together in a ring to form a N -sided polygon,
- (i) show that [3]
- $$N = \frac{2n}{n-4}$$
- (ii) Hence or otherwise, explain why a regular octagon cannot be formed by placing a number of regular polygons in a ring [1]

Credit: **S4 CHS P2/2015 PRELIM Qn 3**

12 Congruency & Similarity

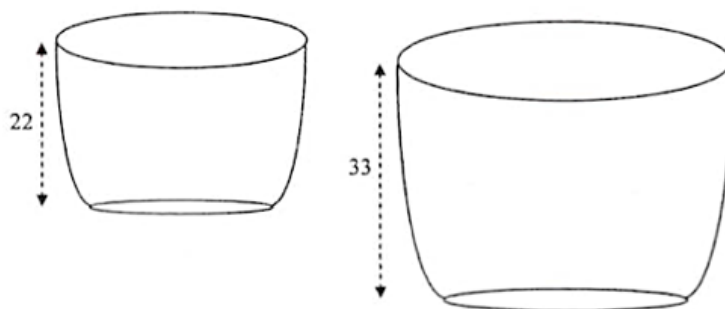
1. The diagram below shows 3 cones that are geometrically similar. The volumes of cone A and cone B are 250 cm^3 and 128 cm^3 respectively



- (a) Find the base area of B [2]
 (b) The volume of C is $\frac{1}{8}$ the volume of A . Find the height of C [2]

Credit: **S4 MFSS P1/2009 PRELIM Qn 24**

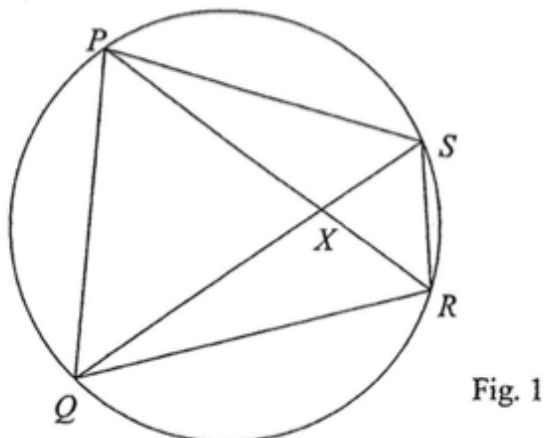
2. The two containers shown in the diagram are geometrically similar. Their heights are 22 cm and 33 cm



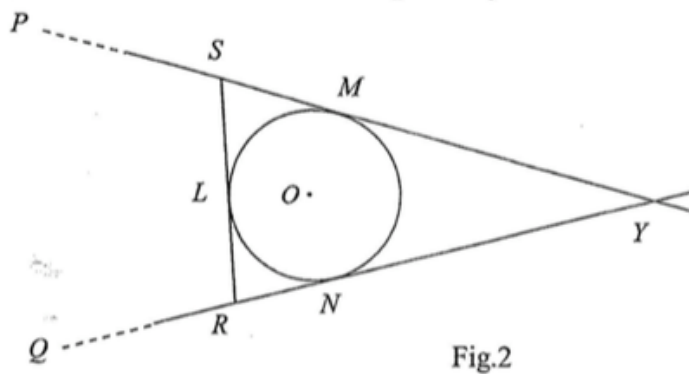
- (a) The diameter of the base of the larger container is 12 cm. Calculate the diameter of the smaller container [1]
 (b) Every part of the surface of the container is painted orange. Given that it costs \$350 to paint the larger container, find the cost of painting the smaller container, correct to the nearest cents [2]
 (c) The containers are completely filled with oil. Given that the smaller container holds 5 litres of oil, find the amount of oil the larger container holds [2]

Credit: **S4 XMSS P2/2011 PRELIM Qn 3(b)**

3. (a) In Figure 1, $PQRS$ is a cyclic quadrilateral with diagonals PR and QS intersecting at X



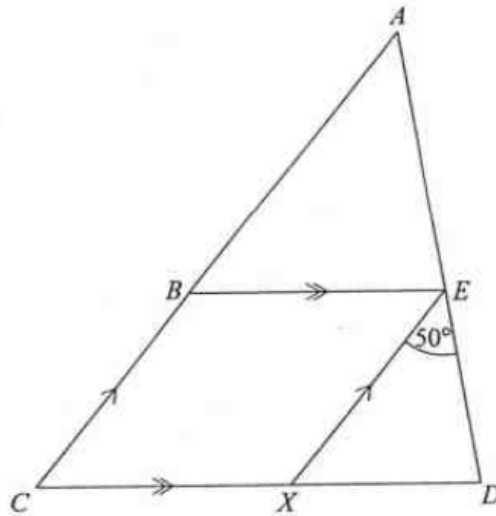
- (i) **Stating your reasons clearly**, prove that $\triangle PQX$ is similar to $\triangle SRX$ [2]
 (ii) Given that $PQ = 10$ cm, $RS = 3$ cm and $QX = 8$ cm, calculate the length of RX [2]
 (iii) Given that $\triangle PXS$ is similar to $\triangle QXR$, find the value of $\frac{PX}{SX}$ [2]
- (b) In Figure 2, the lines PY , QY and SR are tangents to the circle with centre O at the points of contact M , N and L respectively



- (i) **Stating your reasons clearly**, prove that $\triangle ORN$ is congruent to $\triangle ORL$ [4]
 (ii) State the name of the special quadrilateral $OLRN$ [1]
 (iii) Describe how the centre O of the circle can be found by only using a compass and ruler [2]

Credit: S4 ZHSS P2/2011 PRELIM Qn 3

4. The diagram shows $\triangle ACD$



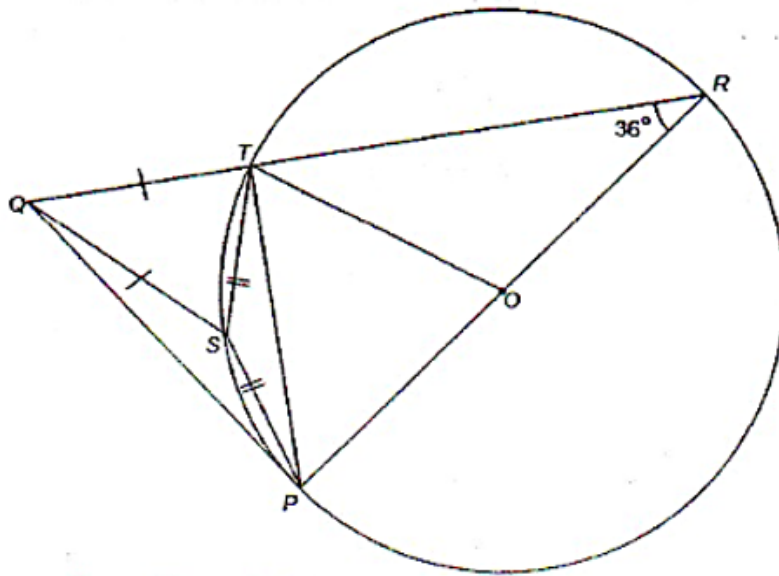
$BCXE$ is a parallelogram such that XE bisects $\angle BED$ and $\angle XED = 50^\circ$

- (a) Find $\angle EDX$ [1]
- (b) Show that $\triangle ABE$ is similar to $\triangle EXD$ [2]
- (c) State another triangle that is similar to ABE and EXD [1]
- (d) The ratio $AE : ED = 4 : 3$
 - (i) Find the ratio $CD : XD$ [1]
 - (ii) Given that the area of $\triangle ABE = 36 \text{ cm}^2$, find the area of $\triangle BXE$ [3]

Credit: **S4 HIHS P2/2015 PRELIM Qn 4**

13 Properties of Circles

1. In the diagram, O is the centre of the circle and points P , S , T and R lie on the circumference of the circle



The tangent at P meets RT produced at Q . $TS = PS$, $TQ = SQ$ and $\angle TRP = 36^\circ$

(a) Find

(i) reflect $\angle POT$

[2]

(ii) $\angle PTS$

[2]

(iii) $\angle PQS$

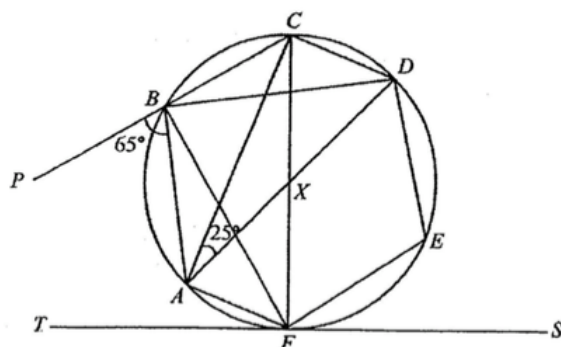
[3]

(b) Show that PS bisect $\angle QPT$

[3]

Credit: **S4 CWSS P2/2009 PRELIM Qn 6**

2. The points A, B, C, D and E lie on the circle

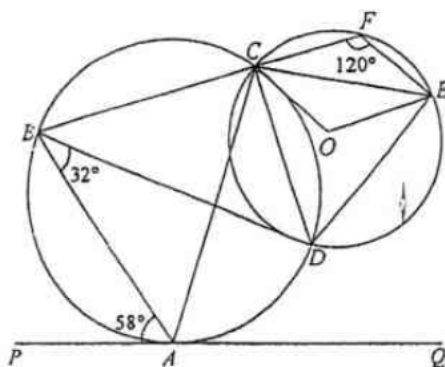


The chords AD and CF intersect at the point X . TS is a tangent to the circle at F and PBC is a straight line. $\angle PBA = 65^\circ$ and $\angle CAD = 25^\circ$

- (a) Find
- (i) $\angle CDA$ [1]
 - (ii) $\angle CBD$ [1]
- (b) Given further that CF is a diameter, prove that X is the centre of the circle [2]
- (c) Giving your reasons, calculate
- (i) $\angle AFT$ [2]
 - (ii) $\angle FED$ [2]
 - (iii) Reflex $\angle FXD$ [2]

Credit: **S4 CHS P2/2011 PRELIM Qn 9**

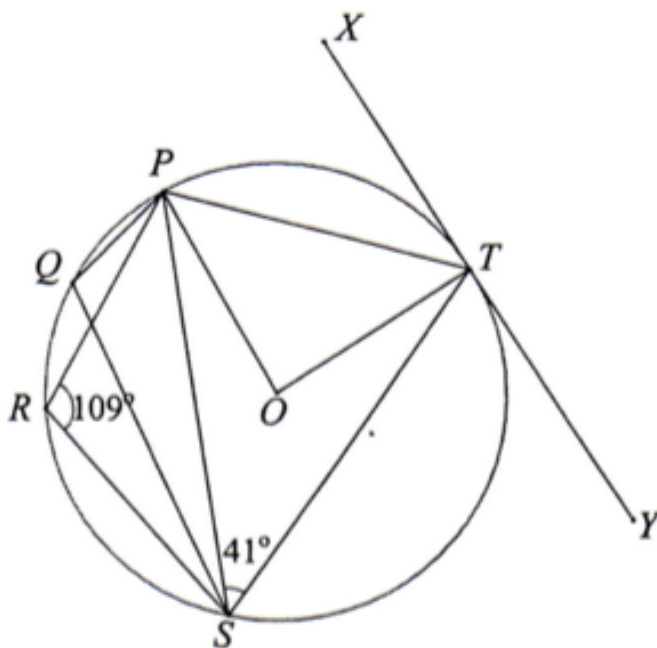
3. In the diagram, PAQ is a tangent to the circle $ABCD$ at A . O is the centre of the circle $CDEF$ and BCF is a straight line. It is given that $\angle PAB = 58^\circ$, $\angle ABD = 32^\circ$ and $\angle CFE = 120^\circ$



- (a) Find
- (i) $\angle ACD$ [1]
 - (ii) $\angle ACB$ [1]
- (b) Explain why BD is a diameter of circle $ABCD$ [2]
- (c) Given that $FC = FE$, show that $\triangle CDE$ is equilateral [3]
- (d) What is the special name given to quadrilateral $COEF$? Justify your answer [3]

Credit: **S4 TKSS P2/2015 PRELIM Qn 7**

4. In the diagram, the points P, Q, R, S and T lie on a circle, centre O . XTY is a tangent to the circle. $\angle PRS = 109^\circ$ and $\angle PST = 41^\circ$



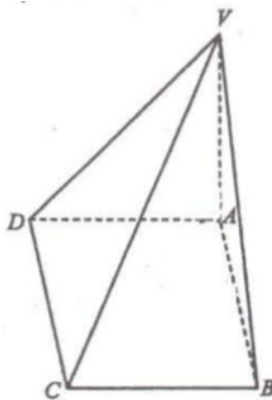
Find, giving reasons for each answer

- | | |
|------------------|-----|
| (a) $\angle PQS$ | [1] |
| (b) $\angle PTS$ | [1] |
| (c) $\angle YTS$ | [2] |
| (d) $\angle OTP$ | [2] |

Credit: **S4 CHIJ SNGS P2/2016 PRELIM Qn 8(a)**

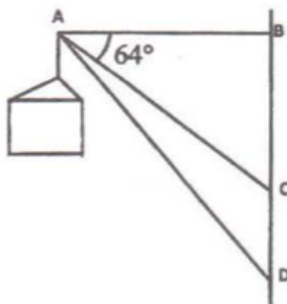
14 Trigonometry

1. (a) The diagram below shows a pyramid with a horizontal rectangular base $ABCD$ and a vertex V vertically above A .



If $AB = 5$ cm, $BC = 7$ cm and $VC = 20$ cm. Calculate

- (i) the length of AC [2]
 - (ii) the length of VA [1]
- (b) The diagram below shows a signboard suspended by three metal poles AB , AC and AD . $AC = 2.5$ m and $AD = 3.5$ m.

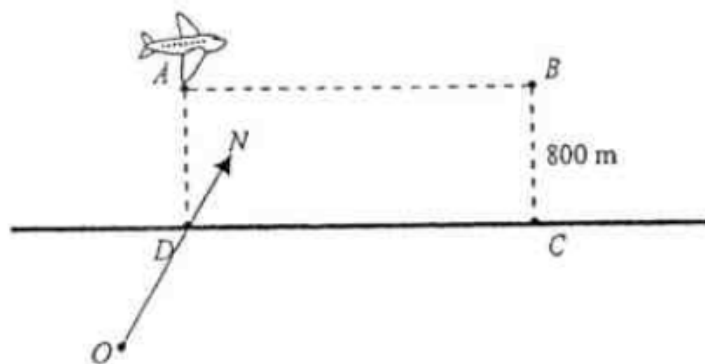


Pole AC makes an angle of 64° with the horizontal pole AB . Calculate

- (i) the angle of depression of D from A [3]
 - (ii) $\cos \angle ACD$ [2]
- (c) Swimmers A and B left island X at the same time. Swimmer A swam 30 km on a bearing of 130° from X and swimmer B swam 25 km on a bearing of 285° from X . Calculate
- (i) the distance between the two swimmers [2]
 - (ii) the bearing of swimmer A from swimmer B [2]

Credit: **S4 AHS P2/2011 PRELIM Qn 6**

2. Three points, O , C and D lie on the ground such that D is due north of O and C is due east of D . An aeroplane flies eastwards from A , a point 800 m directly above D



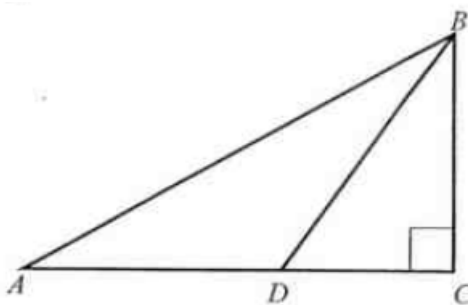
After 30 seconds, it reaches a point B , a point 800 m directly above C . The angles of elevation of the plane from O at A and at B are 45° and 30° respectively. Calculate

- (a) the distance OD and OC [2]
- (b) the bearing of C from O [2]
- (c) the distance AB travelled by the plane, giving your answer to the nearest metre [2]
- (d) the speed of the plane, giving your answer to the nearest km/h [2]

Credit: **S4 ANDSS P2/2015 PRELIM Qn 7**

3. ABC is a right-angled triangle where $AB = 17$ cm, $BC = 8$ cm and $\angle ACB = 90^\circ$. Given that D is a point on AC such that

$$\frac{CD}{AD} = \frac{2}{3}$$

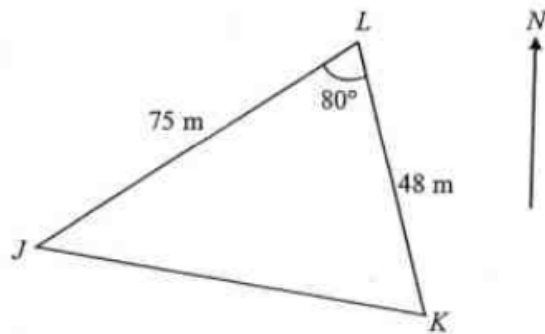


Find, giving your answer as a fraction in its simplest form, the value of

- (a) $\tan \angle CBD$ [2]
- (b) $\cos \angle ADB$ [2]

Credit: **S4 FMS(S) P1/2015 PRELIM Qn 13**

4. J , K and L are three points on level ground



$JL = 75$ m, $KL = 48$ m and $\angle JLK = 80^\circ$. The bearing of K from J is 110° . Calculate

- (a) the distance JK [2]
- (b) the area of the field JKL [2]
- (c) the bearing of J from L [3]

A vertical tree with height 23 m, has its base at L . A man walks from J to K

- (d) Find the greatest angle of elevation of the top of the tree when viewed from any point during his walk [3]

Credit: **S4 NGHS P2/2015 PRELIM Qn 8**

15 Mensuration

1. A cylindrical ceramic mug has an external diameter of 10 cm and a height of 15 cm.

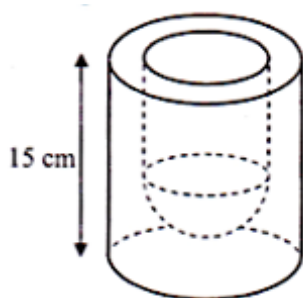


Diagram I

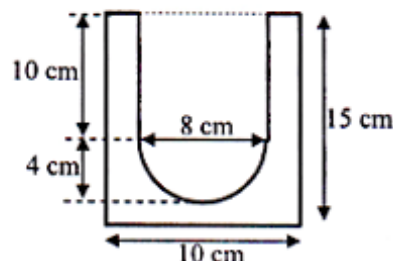


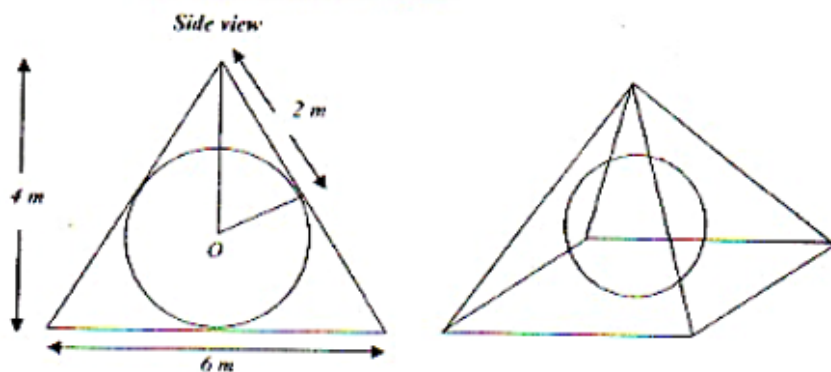
Diagram II

The interior of the mug consists of a cylinder of diameter 8 cm and height 10 cm, with a hemispherical base, as shown in the cross sectional diagram (Diagram II)

- Find the amount of ceramic used to make the mug [3]
- If 200 cm^3 of water is poured into the empty mug, calculate the height of the water level from the bottom of the hemispherical base [3]
- The entire surface area of the ceramic mug needs to be painted over to ensure that it is well waterproofed. Calculate, correct to the nearest square centimetre, the area that needs to be painted [4]

Credit: S4 VS P2/2008 PRELIM Qn 7

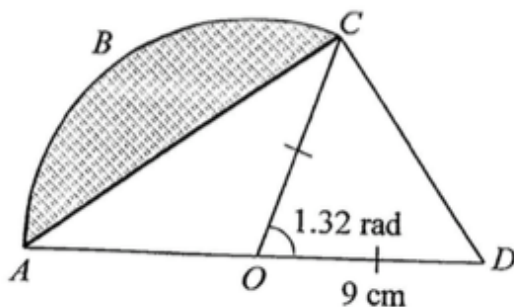
2. A model consists of a solid sphere within a right square pyramid. The sphere is in contact with all 5 faces of a square pyramid. A side view of the setup is shown below



- Given that the radius of the sphere is r m, form an equation in r and show that $r = 1.5$ m [2]
- Calculate the volume of the sphere [2]
- Calculate the surface area of the pyramid [3]
- If the remaining volume in the pyramid is to be completely filled with sand which costs $\$1.60$ per m^3 , find the total cost of sand required [3]

Credit: S4 DSS P2/2009 PRELIM Qn 7

3. The diagram shows a sector $OABC$ of a circle, centre O .

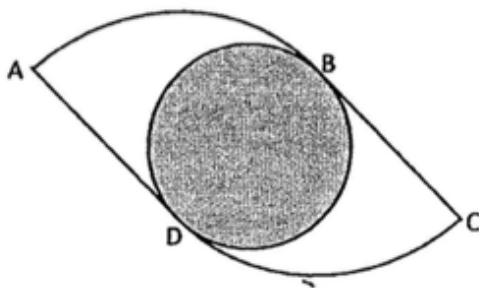


$\triangle OCD$ is isosceles with $OC = OD = 9$ cm and $\angle COD = 1.32$ radians. Find

- (a) $\angle AOC$ in radians [1]
- (b) the arc length ABC [1]
- (c) the area of the shaded region [3]

Credit: **S4 CGS P2/2011 PRELIM Qn 7(a)**

4. The diagram below shows a plan view of a garden. AD and CB are straight lines. $AD = DB = BC = 4$ m and $\angle BAD = \frac{\pi}{4}$ radians. AB and CD are arcs with centre D . DB is the diameter of the circle



- (a) You are required to build a fence along the unshaded region $ABCD$. Calculate the length of the fence required. Leave your answer in terms of π [4]
- (b) Calculate the area of the unshaded region. Leave your answer in terms of π [3]

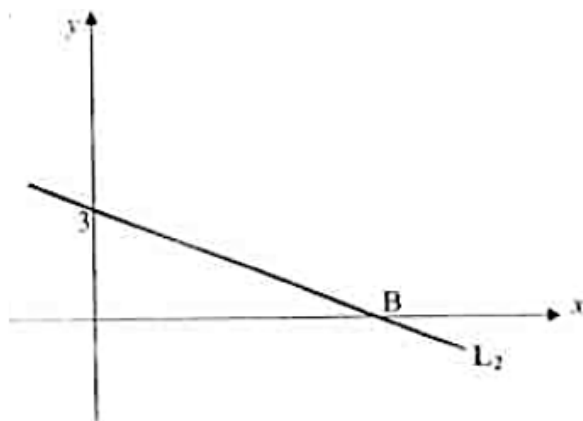
Credit: **S4 PLMGS P2/2011 PRELIM Qn 7**

16 Coordinate Geometry

1. (a) The line $5x = y + 14$ passes through the point $(3p, 7p)$. Find the value of p [1]
- (b) Find the equation of the line passing through the points $(-1, 3)$ and $(7, -2)$, leaving your answer in the form $ax + by = c$, where a , b and c are integers [2]
- (c) The distance between the points $A(1, 2k)$ and $B(1 - k, 1)$ is $\sqrt{10k + 4}$. Find the possible values of k [3]

Credit: **S4 CHIJ TP P1/2009 PRELIM Qn 8**

2. A line L_1 is parallel to the line $L_2 : 2y + x - 6 = 0$ and passes through the point $A(-2, 5)$

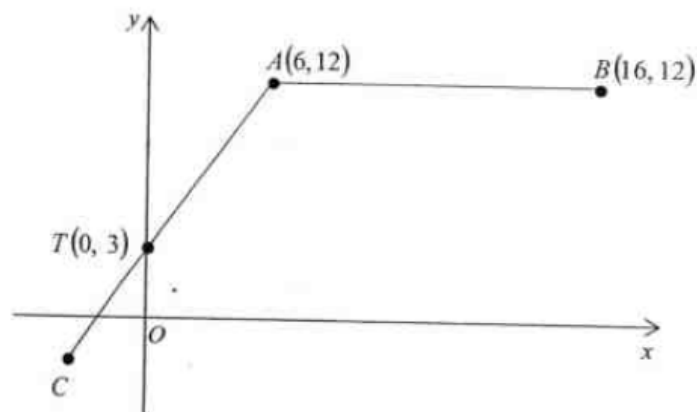


Find

- (a) the equation of L_1 [2]
- (b) the coordinates of B where the line L_2 cuts the x -axis [1]
- (c) the value of k if the coordinates $C(k, 1)$ lies on the line L_1 [1]
- (d) the length of DE where the coordinates of D and E are the points where L_1 cuts the x -axis and y -axis respectively [2]
- (e) the area of the trapezium bounded by the lines L_1 , L_2 and the x and y -axis [2]

Credit: **S4 BWSS P2/2015 PRELIM Qn 5**

3. The diagram shows the sketch of two straight lines ATC and AB



It is given that $AC = 3TC$ and $A(6, 12)$, $B(16, 12)$ and $T(0, 3)$

- Find the coordinates of C
- Find the equation of the line ATC
- Calculate the area of triangle ATB

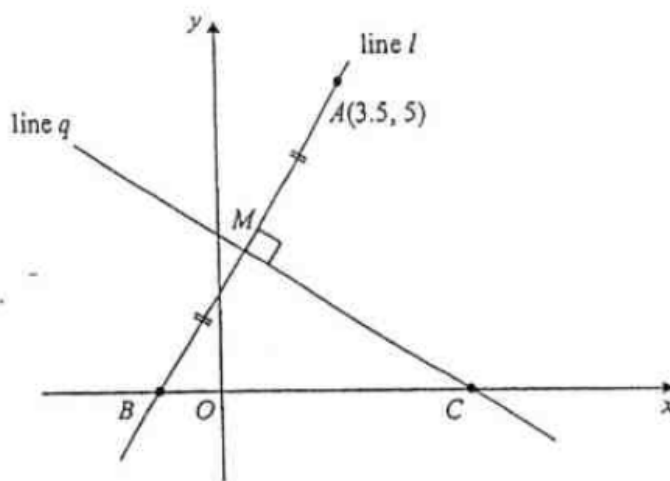
[1]

[2]

[2]

Credit: **S4 SCSS P1/2015 PRELIM Qn 21**

4. The diagram shows line l with the equation $2y = 3 + 2x$ passing through point $A(3.5, 5)$ and the x -axis at B . Another line q is perpendicular to line l . The product of gradients of 2 perpendicular lines is -1 . It passes through M , the midpoint of AB and cuts the x -axis at C



Find

- the coordinates of B
- the mid-point of AB
- the equation of the line q
- the ratio of area of $\triangle BMC$ to area of $\triangle ABC$

[1]

[1]

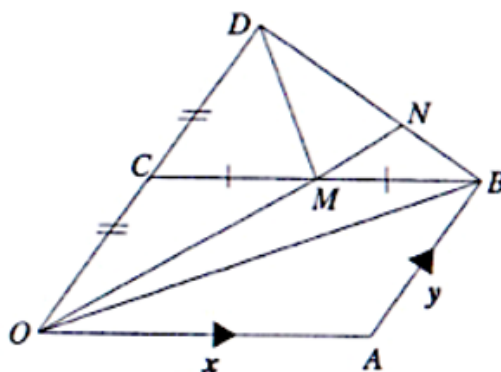
[2]

[2]

Credit: **S4 TKSS P1/2015 PRELIM Qn 17**

17 Vectors in 2 Dimensions

1. (a) Three points A , B and C are such that $\overrightarrow{AC} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$, $\overrightarrow{OC} = \begin{pmatrix} -10 \\ 5 \end{pmatrix}$ and B is a point on OC such that $OB : BC = 2 : 3$
- (i) Find the coordinates of A [1]
- (ii) Find \overrightarrow{OB} [1]
- (iii) Evaluate $|\overrightarrow{AB}|$, correct to 1 decimal place [2]
- (iv) Given that $\begin{pmatrix} 2 \\ k \end{pmatrix}$ is parallel to \overrightarrow{AC} , find the value of k [2]
- (b) $OABC$ is a parallelogram and M is the midpoint of BC .



OC is produced to D so that $OC = CD$. OM is produced to meet BD at N . Given that $\overrightarrow{OA} = \mathbf{x}$ and $\overrightarrow{AB} = \mathbf{y}$, express the following vectors in terms of \mathbf{x} and \mathbf{y}

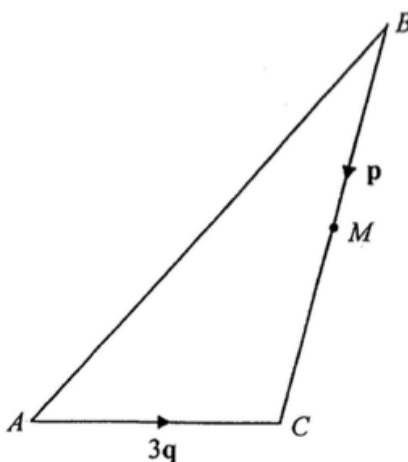
- (i) \overrightarrow{OB} [1]
- (ii) \overrightarrow{OM} [1]
- (iii) \overrightarrow{BD} [1]
- (iv) Given that $ON = \frac{4}{3}OM$, find the numerical value of
- (a) $\frac{\text{area of triangle } MDN}{\text{area of triangle } MDO}$ [1]
- (b) $\frac{\text{area of trapezium } OABD}{\text{area of triangle } OAB}$ [2]

Credit: S4 AMKSS P2/2009 PRELIM Qn 9

2. (a) Given that $\overrightarrow{OX} = \begin{pmatrix} -4 \\ 6 \end{pmatrix}$, $\overrightarrow{XY} = \begin{pmatrix} 15 \\ 5 \end{pmatrix}$, find
- (i) $|\overrightarrow{XY}|$ [2]
- (ii) \overrightarrow{OY} [2]
- (b) Given that $\overrightarrow{XZ} = \begin{pmatrix} 8 \\ k \end{pmatrix}$, $\overrightarrow{XZ} = h(\overrightarrow{OX})$, find the value of h and of k [3]
- (c) The points X , Y and Z are vertices of a triangle, find the equation of the line XZ [3]

Credit: **S4 AMSS P2/2011 PRELIM Qn 4**

3. In triangle ABC , M is the midpoint of BC . It is given that $\overrightarrow{BC} = \mathbf{p}$ and $\overrightarrow{AC} = 3\mathbf{q}$



- (a) Find \overrightarrow{AM} in terms of \mathbf{p} and \mathbf{q} [1]
- (b) X is a point outside triangle ABC such that $\overrightarrow{BX} = k\mathbf{q}$, where k is a positive integer, and \overrightarrow{CX} is parallel to \overrightarrow{AM}
- (i) Express \overrightarrow{CX} in terms of k , \mathbf{p} and \mathbf{q} [1]
- (ii) Find the value of k [1]
- (c) Y is a point on AM such that $5AY = 2AM$. Z is a point on AB such that $AZ : AB = 1 : 4$. Express, in terms of \mathbf{p} and \mathbf{q} ,
- (i) \overrightarrow{CY} [1]
- (ii) \overrightarrow{CZ} [1]
- (d) Using your answers to part (c)(i) and (c)(ii), write down 2 facts about CY and CZ [2]

Credit: **S4 SCGS P1/2011 PRELIM Qn 22**

4. (a) It is given that

$$\mathbf{u} = \begin{pmatrix} 7 \\ -3 \end{pmatrix} \quad \mathbf{v} = \begin{pmatrix} -5 \\ 6 \end{pmatrix}$$

Find

(i) $|\mathbf{u}|$ [1]

(ii) $2\mathbf{u} - \mathbf{v}$ [1]

- (b) $ABCD$ is a quadrilateral in which $\overrightarrow{AB} = 3\mathbf{p}$, $\overrightarrow{DC} = 4\frac{1}{2}\mathbf{p}$ and $\overrightarrow{DA} = 2\mathbf{t}$

(i) Sketch the quadrilateral $ABCD$ [1]

(ii) Write down two important facts about the pair of sides AB and DC [2]

(iii) Express \overrightarrow{BC} , as simply as possible, in terms of \mathbf{p} and/or \mathbf{t} [1]

(iv) The sides DA and CB , when produced, meet at X . Express \overrightarrow{XA} , as simply as possible, in terms of \mathbf{p} and/or \mathbf{t} [1]

(v) Write down the value of
(a) [1]

$$\frac{\text{Area of } \triangle ABD}{\text{Area of } \triangle BDC}$$

(b) [2]

$$\frac{\text{Area of } \triangle ABX}{\text{Area of } ABCD}$$

Credit: **S4 FMS(S) P2/2015 PRELIM Qn 6**

18 Data Analysis & Handling

1. The distribution below shows the number of SMS messages 20 students sent in a month

78 74 84 78 85 94 88 72 68 76
25 84 78 82 78 87 80 92 95 69

- (a) Illustrate the data using a stem-and-leaf diagram

[2]

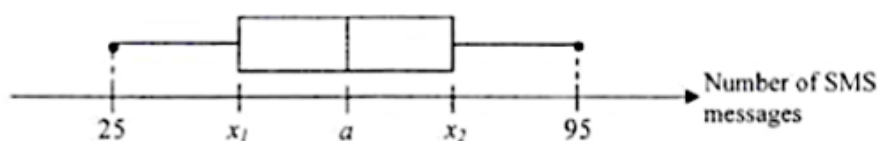
Using the stem-and-leaf diagram, calculate

- (b) (i) the mode
(ii) the mean
(iii) the standard deviation of the distribution
(c) The distribution is represented using a box-and-whisker diagram

[1]

[1]

[1]



- (i) Find the value of a
(ii) Calculate $x_2 - x_1$ and explain what $x_2 - x_1$ represents
(d) Another student sent p SMS messages in the same month. Write the range of values of p such that the median is 80

[1]

[1]

[1]

Credit: S4 ANDSS P2/2011 PRELIM Qn 8

2. The following bar graph is taken from an advertisement



- (a) Express the sales of Brand B as a percentage of the total sales
(b) The same information is shown on a pie chart. Find the angle of the sector which represents the sales of brand D
(c) The advertisement made the claim that

[1]

[1]

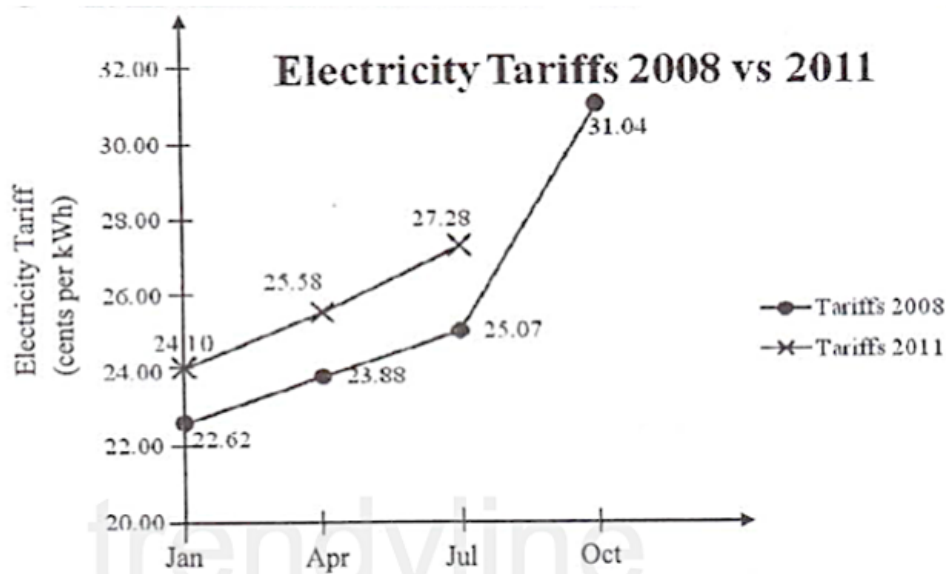
[2]

'Brand C is the most popular soft drink in Singapore in 2011'

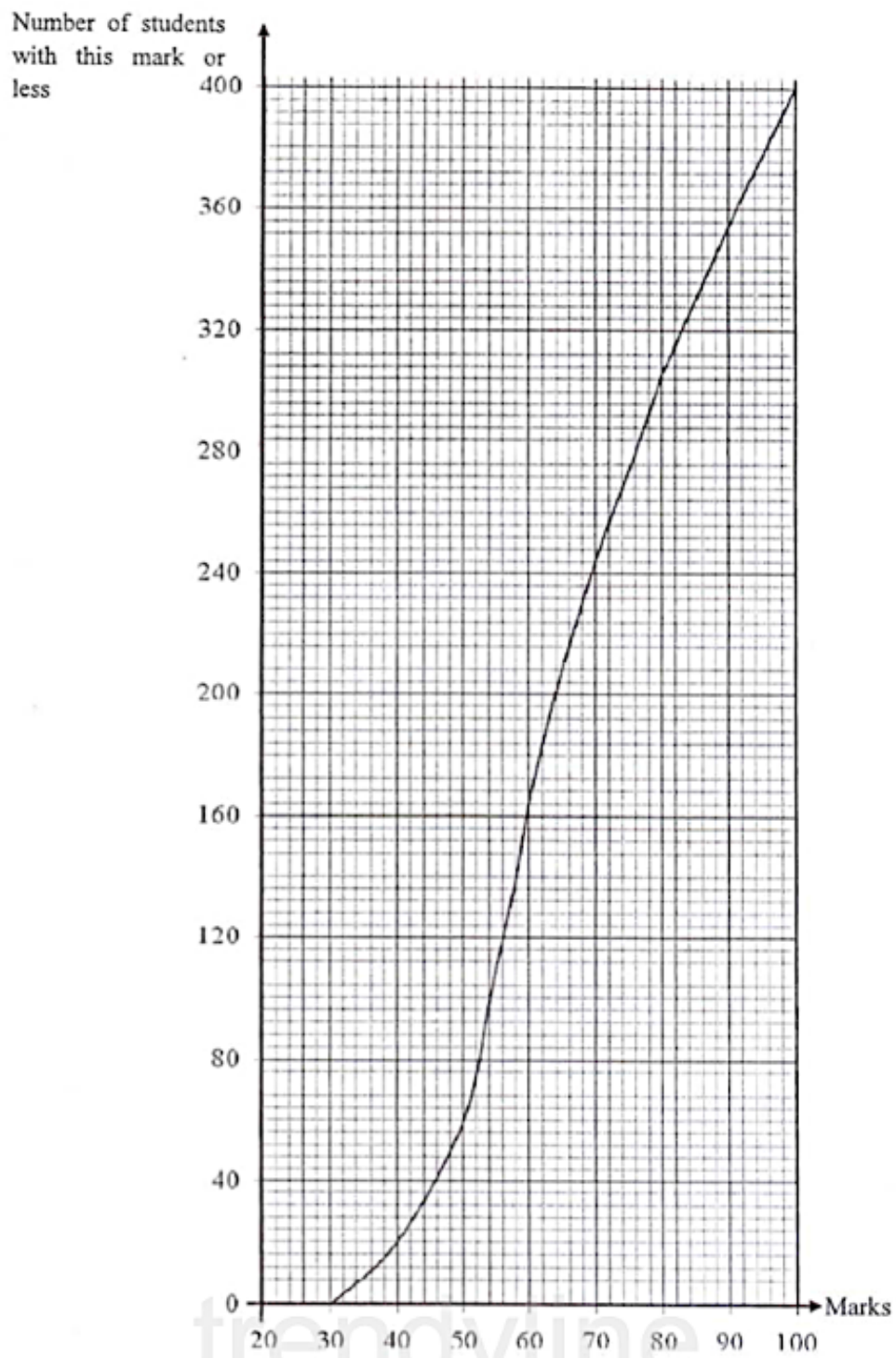
Is this claim valid? Give a reason to support your answer

Credit: S4 CGSS P1/2011 PRELIM Qn 14

3. (a) The line graph given below shows the electricity tariffs in the 4 quarters of 2008 and the first 3 quarters of 2011 in Singapore

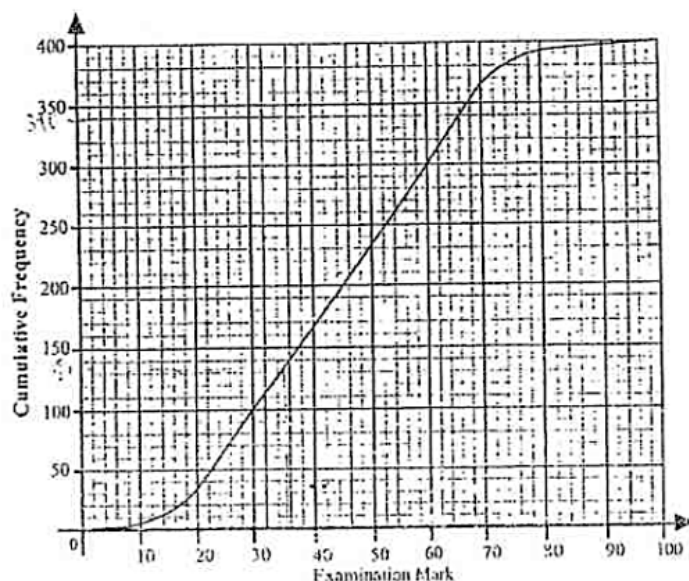


- (i) Calculate the mean tariff rates for electricity in 2008 and 2011 respectively [2]
 - (ii) Calculate the standard deviations of these 2 sets of tariffs [2]
 - (iii) Compare and comment on the results for the two years [1]
- (b) The cumulative frequency curve (**on the next page**) illustrates the marks obtained, out of 100, by 400 DHS students in the recent Year 4 Mathematics Alternative Assessment
- (i) Use the graph to find
 - (a) the median mark [1]
 - (b) the interquartile range [2]
 - (c) the seventieth (70th) percentile [1]
 - (ii) Given that 65% of the students passes the test, use the graph to find the passing mark [2]
 - (iii) A candidate is awarded a "B" grade if he/she scores x marks, where $65 < x \leq 75$. The "A" grader would have to score more than 75 marks. Two candidates were selected from the 400 students at random. Calculate the probability that
 - (a) both were awarded "B" [2]
 - (b) only one of them was awarded "A" [2]

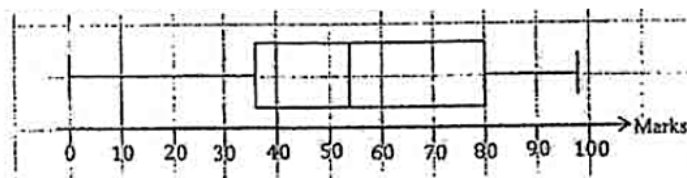


Credit: S4 DHS P2/2011 PRELIM Qn 2

4. The diagram below shows the cumulative frequency curve for the marks of 400 pupils who sat for a Mathematics Examination



- (a) Use your graph to find
- (i) the median mark [1]
 - (ii) the interquartile range [1]
- (b) Two students were selected at random. Find the probability that one of the students obtained less than 35 marks and the other obtained more than 66 marks [2]
- (c) The same group of students sat for a Chemistry Examination and the results are illustrated in a Box-and-Whiskers diagram below



- Use the Box-and-Whisker diagram to find
- (i) the median mark [1]
 - (ii) the interquartile range [1]
- (d) Compare the marks obtained by the 400 students for the Mathematics Examination and Chemistry Examination in two different ways [2]

Credit: **S4 CHS P2/2015 PRELIM Qn 7**

19 Probability

1. (a) A **four-sided** unbiased die and a **six-sided** unbiased die are thrown at the same time. The score of each die is noted
 - (i) Draw a possibility diagram to show the outcomes of the throw [1]
 - (ii) Find, as a fraction in its simplest form, the probability that
 - (a) the sum of the scores is 7 [1]
 - (b) the product of the scores is a multiple of 3 [1]
- (b) Box *A* contains 3 cups of chocolate ice-cream and 5 cups of strawberry ice-cream. Box *B* contains 2 cups of chocolate ice-cream, 4 cups of strawberry ice-cream and 3 cups of vanilla ice-cream. A cup of ice-cream is selected at random from box *A*. It is then placed in box *B* before a cup of ice-cream is selected at random from box *B*
 - (i) Draw a tree diagram to show the probabilities of the possible outcomes [2]
 - (ii) Find, as a fraction in its simplest form, the probability that
 - (a) the two cups of ice-cream selected are of the same flavour [2]
 - (b) the second cup of ice-cream selected is strawberry [2]

Credit: **S4 CGSS P2/2011 PRELIM Qn 7**

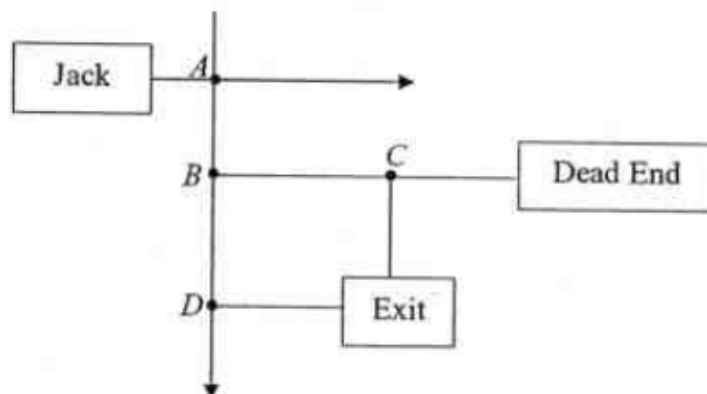
2. (a) A bag contains 10 coloured balls. Of these balls, x are red, $(x + 1)$ are blue and the rest are yellow
 - (i) Write down, in terms of x , the probability of choosing a yellow ball [1]

John picks a ball at random, notes its colour and put it back into the bag. The process is repeated several times

 - (ii) State the event which has the probability, where n is a positive integer [1]
$$\left(\frac{x+1}{10}\right)^n$$
- (b) There are 3 red cards, 4 blue cards and 2 yellow cards in a bag. Jenny draws two cards at random, one after another, from the bag. If the first card drawn is yellow, it is then replaced in the bag and a second card is drawn. If the first card is drawn is red or blue, it is not replaced and a second card is drawn
 - (i) Draw a tree diagram to show the probabilities of the possible outcomes [2]
 - (ii) Find, as a fraction in its simplest form, the probability that
 - (a) one card is yellow and the other is blue [2]
 - (b) at least one of the cards drawn is red [2]

Credit: **S4 SCGS P2/2011 PRELIM Qn 10**

3. The diagram shows four junctions A , B , C and D in the game 'Maze Runner' played at a carnival



Jack decided to participate in the game. He had to find the exit in the shortest time to win a laptop. Once Jack runs past a junction, he is not able to make a turn-around. The probability that Jack goes straight at every junction is $\frac{2}{5}$. Calculate the probability that

- (a) hits the dead end [1]
 (b) wins the laptop [3]

Credit: **S4 HIHS P1/2015 PRELIM Qn 18**

4. Asha and Brennan are sitting for a test. The probability that Asha passes the test is 0.9 and the probability that Brennan passes the test is 0.8
- (a) Find the probability that both Asha and Brennan pass the test [1]

A similar test is set every week and Asha and Brennan can take the test as many times as they like. They decide to stop taking the test only when both of them succeed in passing the test in the same week

- (b) Find the probability that they
- (i) do not succeed in the first week but succeed in the second [1]
 - (ii) succeed in either the first or second week [1]
 - (iii) do not succeed in the first 3 weeks [1]
 - (iv) succeed in one of the first 3 weeks [1]
- (c) Find the probability, in terms of n , that they
- (i) do not succeed in the first n weeks [1]
 - (ii) succeed in one of the first n weeks [1]

Credit: **S4 SCSS P2/2015 PRELIM Qn 9(b)**