

Answer **all** questions.

[C]

1. (a) Expand $\left(2m + \frac{1}{m}\right)^2$. [1]

(i) Given that $\left(2m + \frac{1}{m}\right) = 8$, show that $4m^2 + \left(\frac{1}{m}\right)^2 = 60$. [1]

(b) Given that $x = \sqrt{\frac{3m^2 + 2x}{m^2 - x}}$, express m in terms of x . [3]

(c) Factorise $16(x - 1)^2 - 81$ completely. [3]

[M]

2. Sayf had 5 red marbles and 6 blue marbles.

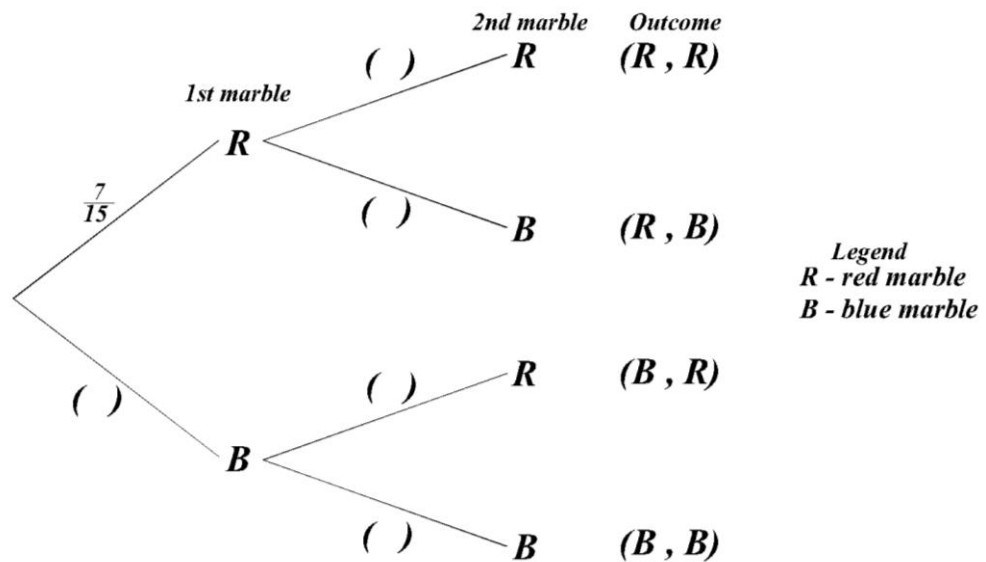
He bought more marbles such that the number of blue marbles bought is equal to the number of red marbles bought.

All the marbles were placed in a jar and one marble was randomly picked.

(a) Given that the probability that he picked a red marble was $\frac{7}{15}$, find the number of red and blue marbles that Sayf bought. [3]

(b) Sayf replaced the marble. He then randomly picked out two marbles, one after another, with replacement.

(i) Copy and complete the following probability tree diagram. [2]



(ii) Find the probability that Sayf picked two marbles of the same colour. [2]

(iii) If a third marble is picked, find the probability that it has the same colour as the first marble. [2]

[M]

3. A gift shop prints and sells greeting cards for various occasions.

- (a) The greeting cards printed by the company are sold in local stores shopping malls. In a particular week, the number of greeting cards available in local stores and shopping malls are in the ratio 4 : 9.

Given that 160 more greeting cards are available for sale in shopping malls, find the total number of greeting cards for sale in that week. [2]

- (b) A store owner bought x greeting cards for \$80 from the gift shop.

- (i) Write down an expression, in terms of x , for the cost of each greeting card in dollars. [1]

The store owner decided to sell the greeting cards at a profit of \$1.50 each.

- (ii) Write down an expression, in terms of x , for the selling price of each greeting card in dollars. [1]

The store owner then sold off 10 greeting cards at the selling price in (ii). He decided to sell the rest of the greeting cards at \$3 each.

- (iii) Write down an expression, in terms of x , for the total amount of money in dollars, that he collected from the sale of all greeting cards. [1]

- (iv) Given that the store owner collected a total of \$215 from the sale of all greeting cards, write down an equation in x to represent this information and show that it reduces to

$$3x^2 - 230x + 800 = 0 \quad [3]$$

- (v) Solve the equation, leaving your answer to 3 significant figures. [3]

- (vi) Find the cost price of each greeting card. [1]

[M]

4. The table below shows the number of durians of three different grades at three shops on average for one-week period.

| | Shop X | Shop Y | Shop Z |
|---------|--------|--------|--------|
| Grade A | 60 | 40 | 90 |
| Grade B | 40 | 70 | 50 |
| Grade C | 80 | 20 | 30 |

- (a) Write down a 3×3 matrix \mathbf{P} to represent the number of customers who purchase durians in Shops X, Y and Z on average in a week. [1]

- (b) One month is defined as four weeks.
Evaluate the matrix $\mathbf{M} = 4\mathbf{P}$. [1]

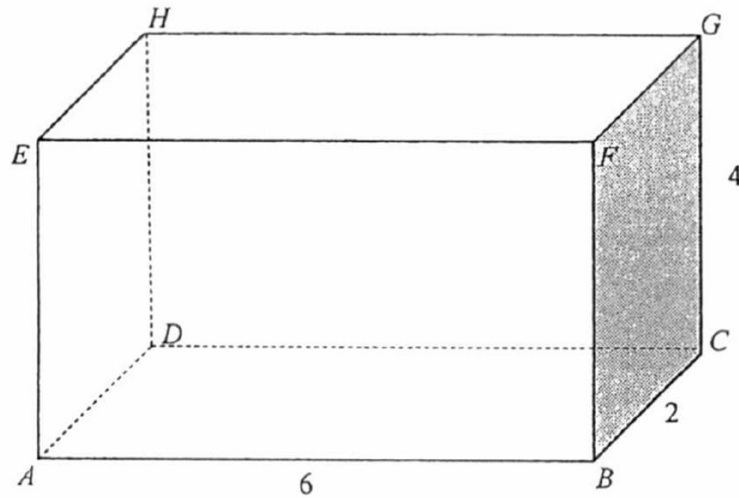
- (c) Evaluate the matrix $\mathbf{T} = \mathbf{MD}$. If $\mathbf{D} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$, explain what the elements of \mathbf{T} represent. [2]

- (d) The cost of each of Grade A, Grade B and Grade C durian is \$10, \$7 and \$5 respectively.
It can be represented as a 1×3 column matrix known as \mathbf{QM} .
Evaluate the matrix \mathbf{QM} . [2]

- (e) State what the elements of \mathbf{QM} represent. [1]
-

[E]

5. (a) A rectangular cuboid $ABCDEFGH$ is shown in the diagram below.
 $AB = 6$ cm, $BC = 2$ cm and $CG = 4$ cm.



- (i) Show that the $\angle HBD = 32.3^\circ$, correct to 1 decimal place. [2]
- (ii) Calculate the $\angle AFC$. [3]
- (iii) Calculate the greatest angle of elevation of the point H when viewed from any point along AB . [2]

- (b) The diagram shows a number grid.

| | | | | |
|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 |

A unit outline as shown above consists of 4 numbers. It can be placed anywhere on the grid.

- (i) If n represents the number in the top left corner of the unit outline, write down an expression, in terms of n , for the number in the bottom right of the rectangle. [1]
- (ii) Show that the difference of any two numbers in the same column is always a multiple of 5. [2]
- (iii) Find the number in the top right corner of the rectangle given that the sum of the four numbers in the unit outline is 96. [3]
-

[M]

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

The variables x and y are connected by the equation

$$y = \frac{x^2}{4} + \frac{1}{x} - 6.$$

Some corresponding values of x and y , are given in the table below.

| | | | | | | | |
|-----|------|------|------|------|-----|-----|-----|
| x | 0.5 | 1 | 2 | 3 | 4 | 5 | 5.6 |
| y | -3.9 | -4.8 | -4.5 | -3.4 | w | 0.5 | 1.7 |

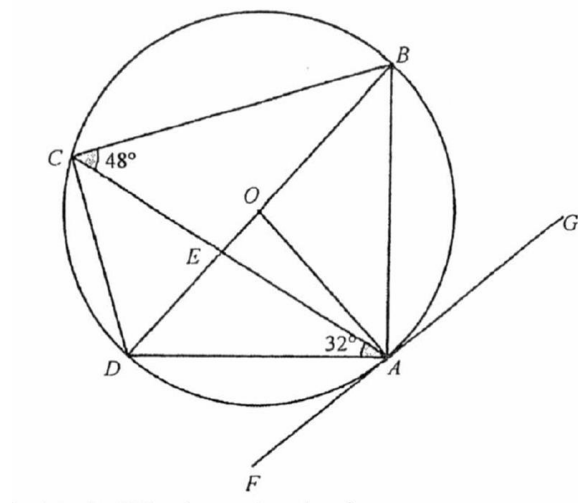
- (a) Find the value of w . [1]
- (b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x -axis for $0 \leq x \leq 6$ and a vertical y -axis for $-5 \leq y \leq 2$. Plot the points given in the table with a smooth curve. [3]
- (c) By drawing a tangent, find the gradient of the curve of the curve at the point $(1, -4.8)$. [2]
- (d) (i) On the same axes, draw the line $y = \frac{1}{2}x - 4$ for $0 \leq x \leq 6$. [2]
- (ii) Write down the x -coordinate of the point where the line intersects the curve for $0 \leq x \leq 6$. [1]
- (iii) This value of x is a solution of the equation

$$x^3 + Ax^2 + Bx + 4 = 0.$$

Find the value of A and the value of B . [2]

[E]

7. Given in the diagram below, a line FG is tangent to the circle of centre O . A quadrilateral touches the circle at $ABCD$. AC intersect BD at E .
 $\angle ACB = 48^\circ$ and $\angle CAD = 32^\circ$



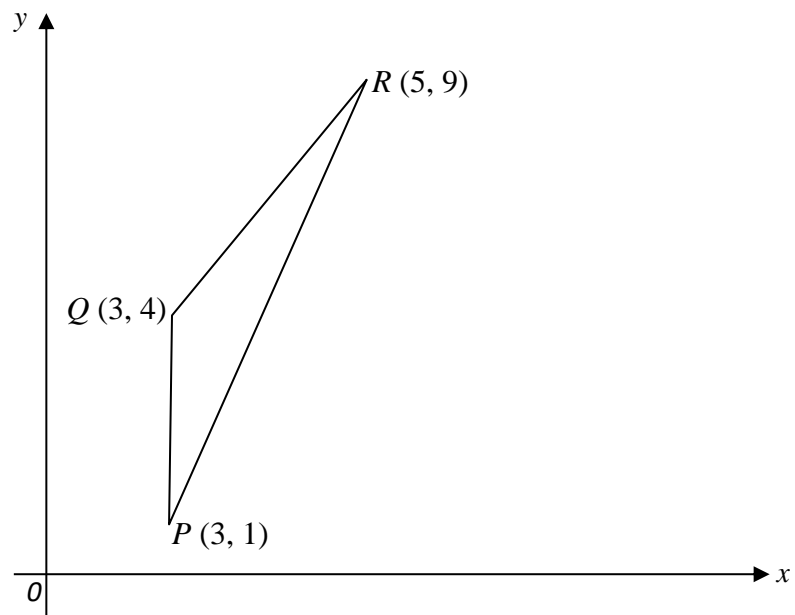
(a) Find the value of the following angles, stating reasons,

- (i) $\angle ABO$, [2]
- (ii) $\angle BDA$, [1]
- (iii) $\angle CDA$, [2]
- (iv) $\angle GAB$, [2]

(b) Is BD parallel to GF ? Justify your answer. [2]

[E]

8. The points $P(3, 1)$, $Q(3, 4)$ and $R(5, 9)$ are shown in the diagram.

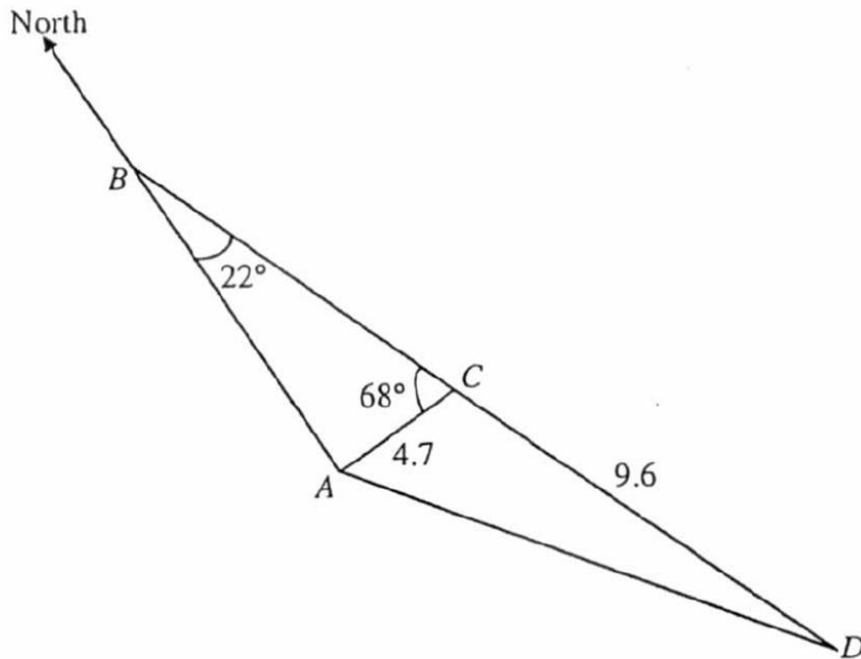


Find the

- (a) coordinates of S such that $PQRS$ is a parallelogram, [1]
- (b) length PR , [1]
- (c) equation of the line that passes through P and is parallel to the line $3y = 4x + 5$. [4]
- (d) area of triangle PQR and [2]
- (e) hence the perpendicular distance from Q to PR . [2]
-

[M]

9. Four points, A , B , C and D are marked out on a flat ground with A due south of B . It is given that $\angle ABC = 22^\circ$, $\angle BCA = 68^\circ$. $AC = 4.7$ m and $CD = 9.6$ m.



Calculate

- (a) AD , [2]
(b) $\angle CAD$, [2]
(c) the bearing of C from D , [1]
(d) the area of ACD . [2]

A drone, H is hovering at a height of 450 m at a point which is vertically above C .

- (e) Find the smallest angle of elevation of the helicopter when observed along AD . [2]
(f) Find the cost to fence up the area ACD given that the cost of fencing is \$2.70 per metre. [2]
-

[M]

10. Ann is making some financial planning prior to starting her studies at the University of Homeland (UH) in August 2019.
She will be pursuing her Bachelor's Degree in Early Childhood.

Information that Ann needs is found on the Annex page.

Ann is also planning ahead for her annual cost of living as she plans to stay in boarding school to save the daily transportation time of 2 hours every day.

- (a) Calculate her maximum estimated annual cost of living, excluding the vacation period. [1]

- (b) Ann receives \$700 allowance from her parents every month.
To earn additional income, she works as a part-time tutor in a learning centre.
She is paid \$30 per hour.

On average, find the number of hours that she will need to work monthly to cover her cost of living. [3]

- (c) Ann has to complete four years of education in UH for her degree.
She plans to take a POSB bank loan for his tuition fee payment.

Suggest whether it is more practical for her to take a 4 or 8 years bank loan if Ann wishes to save a larger amount every month. Justify the decision that you make and show your calculations clearly. [6]

ANNUAL TUITION FEES

For new students enrolled in Academic Year 2019/ 2020

| University of Homeland Fee payable by students per academic year. | | | | | |
|--|------------------------------|--------------------------|--------------------|-------------|----------|
| Course | Arts & Social Sciences | Business/ Accountancy | Early childhood | Engineering | Law |
| Annual Tuition Fees | \$ 7040 | \$8340 | \$7040 | \$7040 | \$10 500 |

COST OF LIVING

Full-time undergraduate studies (2017)

The annual costs below have been derived based on a conservative estimate for a reasonably comfortable lifestyle, excluding the vacation period.

| Item | Annual Estimated Cost |
|---|-----------------------|
| On-campus accommodation (single-occupancy) | \$3165 |
| Meals | \$2500 |
| Personal expenses | \$2100 |
| Transportation within Singapore | \$700 |
| Average cost of books/ supplies | \$400 |

Notes:

- All amounts stated are in Singapore dollars.
- The costs are calculated on an annual basis, excluding the vacation period.

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