Name:_____

	Class	Index Number

Jurong West Secondary School

Mid-Year Examinations 2017

80
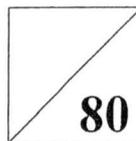
MATHEMATICS

4048/01

Secondary Four Express/ Five Normal Academic

Paper 1

4 May 2017

0800 – 1000

2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

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.
The use of an approved scientific calculator is expected, where appropriate.
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 or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

After checking of answer script		
Checked by Student	**Signature**	**Date**

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

This document consists of __23__ printed pages.

Answer **all** questions.

1. Factorise completely $4ax - 3ay - 16x + 12y$.

Answer ... ... [2]

2. Solve $(3x - 4)(x - 2) = 1$.

Answer $x =$ ... ... or ... ... [2]

3. Mr Heng bought a painting for $3 500. Some years later he sold it for a profit of 150% on the price he paid. Find the selling price.

Answer $ ... ... [2]

4. The temperature of a pie was $-4°C$ when taken out of the freezer. The pie was immediately heated up, and after 8 minutes its temperature was $16°C$.

    (a) By how much did the temperature increase during the 8 minutes?

Answer (a) ... ... $°C$ [1]

    (b) Given that the temperature of the pie increased at a constant rate, calculate the number of minutes it has been warmed when its temperature reached $2°C$?

Answer (b) ... ... minutes [1]

5. Miss Gan invested $7 500 in a saving account for 6 years. The rate of compound interest was fixed at 3% per annum compounded half yearly. Calculate the amount of interest Miss Gan earned at the end of 6 years.

Answer $ ... ... [2]

6. Highlighters are sold in packs of three at a cost of x cents per pack. Find an expression for the number of highlighters that can be bought for y dollars.

Answer................................. [2]

7. Simplify

(a) $5(2x + y) - 4(3x - 2y)$,

Answer (a) .... [1]

(b) $\left(\dfrac{x^{12}}{81}\right)^{-\frac{1}{4}}$

Answer (b) .... [2]

8. (a) Express $x^2 - 6x + 13$ in the form $(x - p)^2 + q$.

Answer (a) .... [2]

(b) Write down the coordinates of the minimum point of the graph $y = x^2 - 6x + 13$.

Answer (b)   (........ , ...) [1]

9. (a) Solve the inequality $-6 < 2x + 7 \le 7$.

Answer (a) .... [2]

(b) Hence write down smallest integer value of x which satisfies $-6 < 2x + 7 \le 7$.

Answer (b) .... [1]

10. 30 students took a Mathematics test. The mean mark was 13.2 and the median was 14.

An extra student took the test late. The new mean was 13.

(a) What mark did the extra student get?

Answer (a) .... [2]

(b) Complete the sentence below with the correct phrase from the list.

The new median …

> is definitely smaller than 14.
>
> is definitely bigger than 14.
>
> might be smaller than 14 but might still be 14.
>
> might be bigger than 14 but might still be 14.
>
> is still 14.

Answer (b) The new median ....

.... [1]

11. P is the point $(3, 4)$. Q is the point $(-5, 1)$.

(a) Write down the column vector $\overrightarrow{PQ}$.

Answer (a) .... [1]

(b) Find $\left|\overrightarrow{PQ}\right|$.

Answer (b) .... [2]

12. $\xi = \{\text{integers } x : 3 \le x \le 11\}$

$A = \{\text{factors of } 24\}$

$B = \{\text{prime numbers}\}$

(a) Draw a Venn diagram to illustrate this information. [2]
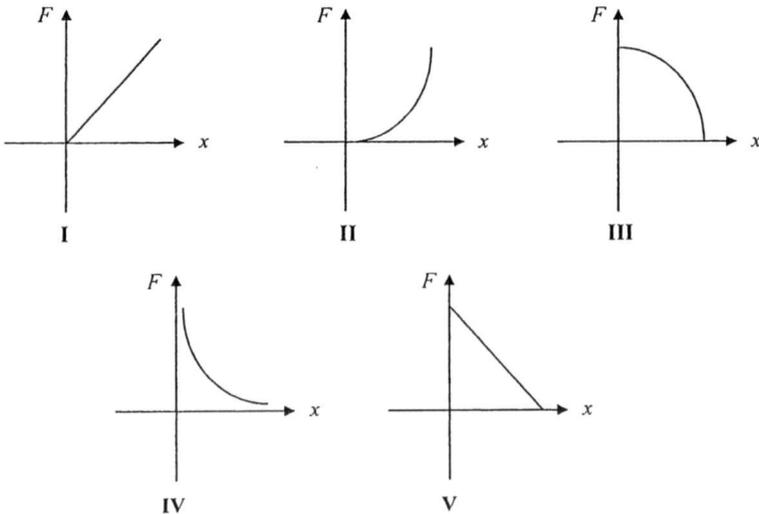
Answer (a)

(b) Write down $n(A \cup B)$.

Answer (b) .... [1]

(c) List the elements contained in the set $A' \cap B'$.

Answer (c) .... [1]

---

13. The force of attraction, F newtons, between two magnets is inversely proportional to the square of the distance, x centimetres, between them.

(a) Which one of the following sketch graphs below represents the relationship between the force of attraction and the distance?

I

II

III

IV

V

Answer (a) Graph .... [1]

(b) When the magnets are 4 cm apart, the force is 3 newtons. Find the equation connecting F and x.

Answer (b) .... [2]

(c) Find the distance between the two magnets when the force is 0.75 newtons.

Answer (c) .... cm [1]

---

14. The actual perimeter of a reservoir is 37 km. The perimeter of the reservoir is represented by a length of 185 cm on the map.

(a) Write down the scale of the map in the form of $1:n$.

Answer (a) 1 : .... [1]

(b) A plantation has an actual area of 3.2 km². Find the area, in square centimeters, of the plantation on the map.

Answer (b) .... cm² [2]

15. When written as product of their prime factors,

$$P = 2^3 \times 3^6$$
$$Q = 2^3 \times 3 \times 5,$$
$$R = 2^2 \times 3^2 \times 5.$$

(a) Find the value of the cube root of P.

Answer (a) .... [1]

(b) Given that the HCF and LCM of Q, R and S is 60 and 2520 respectively, find the smallest possible value of S.

Answer (b) .... [2]

16. Two containers are geometrically similar. The larger container has a capacity of 1.08 litres and the smaller container has a capacity of 0.32 litres. The height of the larger container is 18 cm.

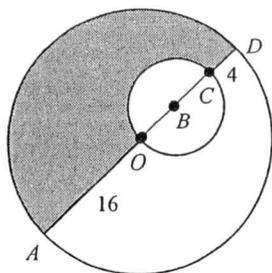(a) Calculate the height of the smaller container.

Answer (a) .... cm [2]

(b) The ratio surface area of larger container : surface area of smaller container can be written in the form $k : 1$. Find the value of k.

Answer (b) k = ... [2]

17.

**(a)** In the diagram, the big circle, centre O, has a radius of 16 cm. The small circle, centre B, has OC as diameter. $AOBCD$ is a straight line with $CD = 4$ cm. Find the perimeter of the shaded region, leaving your answer in terms of π.

Answer (a) .... cm [2]

(b) A point is chosen, at random within the big circle. Find the probability that this point is in the shaded region.

Answer (b) .... [2]

18. These box plots show the distributions of the heights of students in two schools A and B.
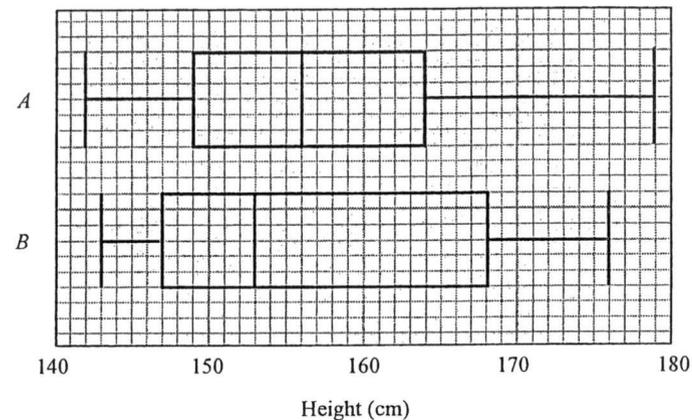
Height (cm)

(a) Find the median for school A.

Answer (a) .... cm [1]

(b) Find the interquartile range for school B.

Answer (b) .... cm [1]

(c) Here are two statements comparing the heights for the two schools.

For each one, write whether you agree or disagree. Give a reason for each answer.

(i) On average, students from school A is taller than students from school B.

Answer (c)(i) .... because ....

....

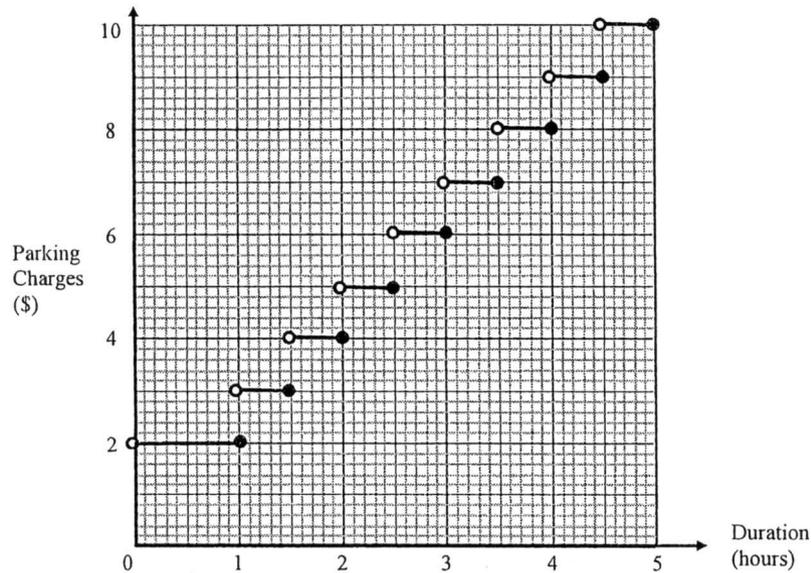.. [1]

(ii) A greater proportion of the students has height of more than 165 cm in school *A* than in school *B*.

Answer (c)(ii)............................ because ....

....

.... [1]

---

19. The step-function graph below shows the parking charges for the first 5 hours at Carpark *P*.

Answer (b)(i)

(a) Find the parking charges for a car that is parked at Carpark *P* for

(i) $1\frac{1}{2}$ hours,

Answer (a)(i) $ .... [1]

(ii) 3 hours 10 minutes.

Answer (a)(ii) $ .... [1]

(b) Another nearby carpark, Carpark *Q* offers the parking charges as shown below.
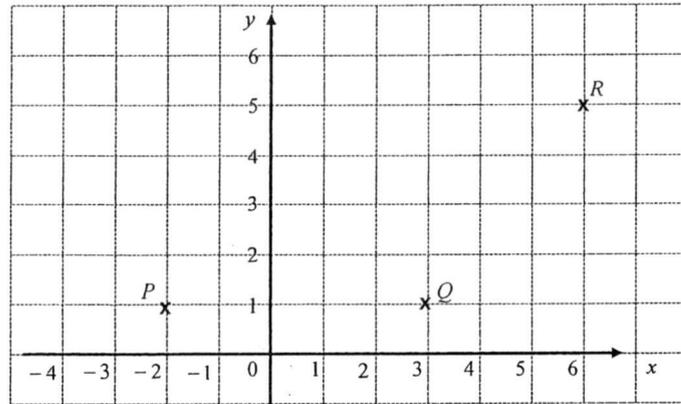
> $2.60 upon entry.
> 2 cents per minute thereafter
> (Maximum charges of $8)

Mr Chan wishes to park his car at one of these carparks for $2\frac{1}{2}$ hours.

(i) On the same axes, draw the graph of parking charges at Carpark *Q*. [1]

(ii) State the carpark Mr Chan should choose to park his car.

Answer (b)(ii) .... [1]

20. The diagram shows three points $P(-2, 1)$, $Q(3, 1)$ and $R(6, 5)$.

(a) Find the gradient of PR.

Answer (a) .... [1]

(b) Find the area of triangle PQR.

Answer (b) .... [1]

(c) Find the value of $\tan \angle QPR$.

Answer (c) .... [1]

(d) $PQRS$ is a trapezium with PQ parallel to SR. The area of the trapezium is 28 units^2. Find the coordinates of S.

Answer (d) S (......... , ...) [2]

21. The diagram represents the speed-time graph of a moving object.
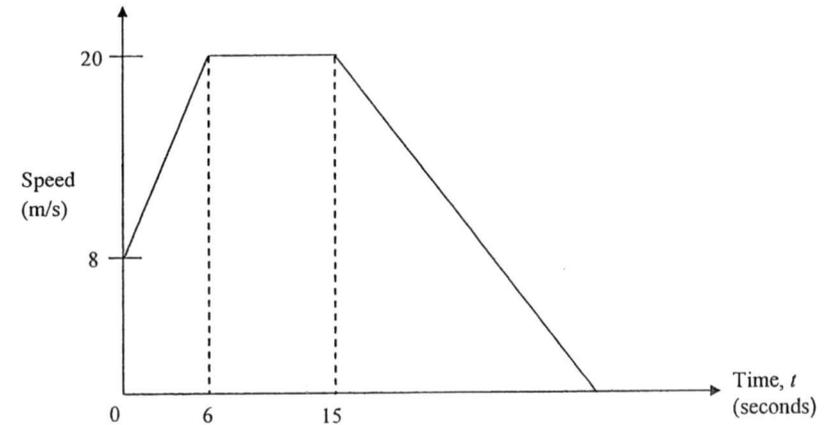
**(a)** Calculate the speed of the object when $t = 4$.

Answer (a) .... m/s [2]

(b) Calculate the distance travelled in the first 15 seconds.

Answer (b) …………..……….….…… m [2]

(c) Given that the rate at which the object slows down after $t = 15$ is equal to half the rate at which it accelerates during the first 6 seconds, calculate the time at which it stops.

Answer (c) …………..…..….…..…… s [2]

22. A circle, centre O, passes through the points P, Q, R, S and T. QT is the diameter of the circle, angle $SOT = 70°$ and QR is parallel to OS.
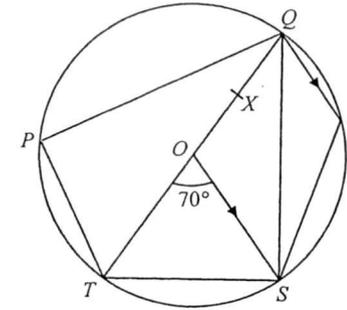
(a) Find

(i) angle OQS,

Answer (a)(i) angle OQS =…….…..…… [1]

(ii) angle OTS,

Answer (a)(ii) angle OTS =……….....…. [1]

(iii) angle QRS,

Answer (a)(iii) angle QRS =……….....…. [1]

(iv) angle *QSR*,

Answer (a)(ii) angle QSR =.............. [1]

(b) *X* is the point on *QT* such that $QX = \frac{1}{4}QT$. Given that the area of triangle *PQT* is 90 cm², calculate the area of *PXT*.

Answer (b) .... cm² [2]

23.
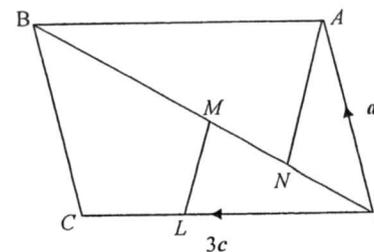
OABC is a parallelogram. *M* is the midpoint of *OB*, *N* is the point on *OM* such that $OM = 2ON$ and *L* is the point on *OC* such that $OL = 2LC$. $\overrightarrow{OA} = a$, $\overrightarrow{OC} = 3c$ and $\overrightarrow{ML} = -\frac{1}{2}a + \frac{1}{2}c$.

(a) Write each of the following in terms of *a* and *c*. Give your answers in the simplest form.

(i) $\overrightarrow{OB}$

Answer (a)(i) .... [1]

(ii) $\overrightarrow{ON}$

Answer (a)(ii) .... [1]

(iii) $\overrightarrow{AN}$

Answer (a)(iii) .... [2]

(b) Explain why *ML* is parallel to *AN*.

Answer (b) ....

....

.... [1]

(c) Find the ratio *AN* : *ML* .

Answer (c) .... [1]

End of Paper

Answer **all** questions.

1. Factorise completely $4ax - 3ay - 16x + 12y$.

$4ax - 3ay - 16x + 12y = a(4x - 3y) - 4(4x - 3y)$ M1

$= (a - 4)(4x - 3y)$ A1

Answer... [2]

2. Solve $(3x - 4)(x - 2) = 1$.

$(3x - 4)(x - 2) = 1$

$3x^2 - 6x - 4x + 8 = 1$ M1

$3x^2 - 10x + 7 = 0$

$(3x - 7)(x - 1) = 0$

either $3x - 7 = 0$ or $x - 1 = 0$

$x = 2\dfrac{1}{3}$ $x = 1$ A1

Answer $x = $ .... or .... [2]

3. Mr Heng bought a painting for $3 500. Some years later he sold it for a profit of 150% on the price he paid. Find the selling price.

Selling price $= \dfrac{250 \times 3500}{100}$ M1

$= \$8750$ A1

Answer $ .... [2]

4. The temperature of a pie was $-4^\circ C$ when taken out of the freezer. The pie was immediately heated up, and after 8 minutes its temperature was $16^\circ C$.

(a) By how much did the temperature increase during the 8 minutes?

Increase in temperature $= 16 - (-4) = 20^\circ C$ B1

Answer (a) .... $^\circ C$ [1]

(b) Given that the temperature of the pie increased at a constant rate, calculate the number of minutes it has been warmed when its temperature reached $2^\circ C$?

$20^\circ C$ take 8 minutes

$6^\circ C$ take $\dfrac{6 \times 8}{20} = 2.4$ minutes   B1

Answer (b) .... minutes [1]

5. Miss Gan invested $7 500 in a saving account for 6 years. The rate of compound interest was fixed at 3% per annum compounded half yearly. Calculate the amount of interest Miss Gan earned at the end of 6 years.

Total amount $= 7500\left(1 + \dfrac{1.5}{100}\right)^{12}$ M1

$\approx \$8967.14$

Interest $= 8967.136286 - 7500$

$\approx \$1467.14$ A1

Answer $ .... [2]

6. Highlighters are sold in packs of three at a cost of x cents per pack. Find an expression for the number of highlighters that can be bought for y dollars.

3 highlighters cost x cents

1 highlighter costs $\dfrac{x}{3}$ cents

Number of highlighters that can be bought $= 100y \div \dfrac{x}{3}$

> M1 for either method seen

$$= \dfrac{300y}{x}$$ A1

Answer.............................. [2]

7. Simplify

(a) $5(2x+y)-4(3x-2y)$,

$5(2x+y)-4(3x-2y) = 10x+5y-12x+8y$

$$= -2x+13y \qquad \boxed{B1}$$

Answer (a) .... [1]

(b) $\left(\dfrac{x^{12}}{81}\right)^{-\frac{1}{4}}$

$\left(\dfrac{x^{12}}{81}\right)^{-\frac{1}{4}} = \left(\dfrac{81}{x^{12}}\right)^{\frac{1}{4}}$ M1   or $\left(\dfrac{x^{12}}{81}\right)^{-\frac{1}{4}} = \dfrac{x^{-3}}{\frac{1}{3}}$ M1

$$= \dfrac{3}{x^3} \qquad \boxed{A1} \qquad\qquad = \dfrac{3}{x^3} \qquad \boxed{A1}$$

Answer (b) .... [2]

8. (a) Express $x^2 - 6x + 13$ in the form $(x-p)^2 + q$.

$$x^2 - 6x + 13 = x^2 - 6x + \left(-\dfrac{6}{2}\right)^2 - \left(-\dfrac{6}{2}\right)^2 + 13$$

$$= (x-3)^2 + 4 \qquad \boxed{\text{B1 B1 for correct } p \text{ and } q}$$

Answer (a) .... [2]

(b) Write down the coordinates of the minimum point of the graph $y = x^2 - 6x + 13$.

Coordinates of minimum point $=(3, 4)$ B1

Answer (b)   (........., ...) [1]

9. (a) Solve the inequality $-6 < 2x + 7 \le 7$.

$-6 < 2x + 7$ and $2x + 7 \le 7$

$2x > -13$ $\qquad\qquad 2x \le 0$

$x > -6\dfrac{1}{2}$ $\qquad\qquad x \le 0$ B1 for either $x > -6\dfrac{1}{2}$ or $x \le 0$ seen

$\therefore \quad -6\dfrac{1}{2} < x \le 0$ B1

Answer (a) .... [2]

(b) Hence write down smallest integer value of x which satisfies $-6 < 2x + 7 \le 7$.

$x = -6$ B1

Answer (b) .... [1]

10. 30 students took a Mathematics test. The mean mark was 13.2 and the median was 14.

An extra student took the test late. The new mean was 13.

(a) What mark did the extra student get?

Mark $= 31 \times 13 - 30 \times 13.2$ M1

$\quad\quad\quad = 403 - 396$

$\quad\quad\quad = 7$ A1

Answer (a) .... [2]

(b) Complete the sentence below with the correct phrase from the list.

The new median ...

> is definitely smaller than 14.
>
> is definitely bigger than 14.
>
> might be smaller than 14 but might still be 14.
>
> might be bigger than 14 but might still be 14.
>
> is still 14.

Answer (b) The new median <u>might be smaller than 14 but might still be 14.</u>   B1

11. P is the point $(3, 4)$. Q is the point $(-5, 1)$.

(a) Write down the column vector $\overrightarrow{PQ}$.

$$\overrightarrow{PQ} = \overrightarrow{OQ} - \overrightarrow{OP} \quad\quad \text{or} \quad\quad \overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ}$$

$$= \begin{pmatrix} -5 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \end{pmatrix} \quad\quad\quad\quad\quad = \begin{pmatrix} -3 \\ -4 \end{pmatrix} + \begin{pmatrix} -5 \\ 1 \end{pmatrix}$$

$$= \begin{pmatrix} -8 \\ -3 \end{pmatrix} \quad \boxed{B1} \quad\quad\quad\quad\quad = \begin{pmatrix} -8 \\ -3 \end{pmatrix} \quad \boxed{B1}$$

Answer (a) .... [1]

(b) Find $\left| \overrightarrow{PQ} \right|$.

$$\left| \overrightarrow{PQ} \right| = \sqrt{(-8)^2 + (-3)^2} \quad \boxed{M1}$$

$$= \sqrt{73}$$

$$\approx 8.54 \text{ units} \quad \boxed{A1}$$
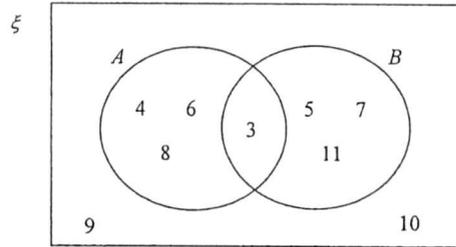
Answer (b) .... [2]

12. $\xi = \{\text{integers } x: 3 \le x \le 11\}$

$A = \{\text{factors of } 24\}$

$B = \{\text{prime numbers}\}$

(a) Draw a Venn diagram to illustrate this information. [2]

Answer (a)

ξ

A : 4 6 8

3

B : 5 7 11

9

10

B1 B1 for any two out of four groups of numbers correct

(b) Write down $n(A \cup B)$.

$n(A \cup B) = 7$ B1

Answer (b) .... [1]
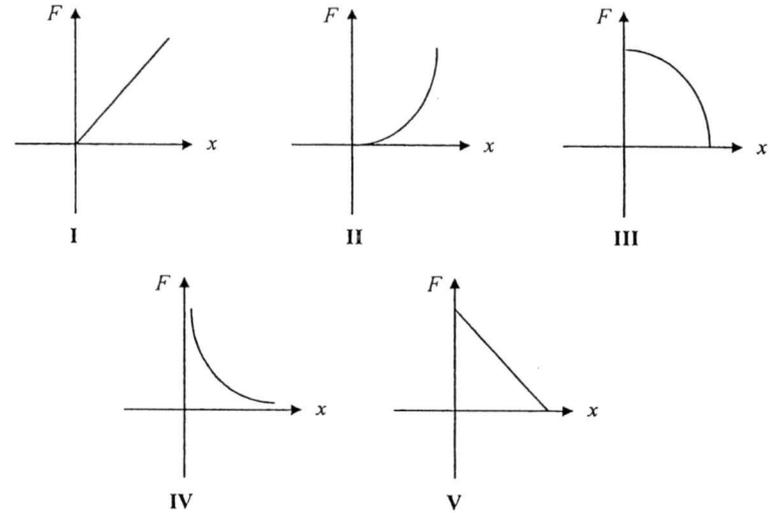
(c) List the elements contained in the set $A' \cap B'$.

$A' \cap B' = \{9, 10\}$ B1

Answer (c) .... [1]

13. The force of attraction, F newtons, between two magnets is inversely proportional to the square of the distance, x centimetres, between them.

(a) Which one of the following sketch graphs below represents the relationship between the force of attraction and the distance?

I

II

III

IV

V

Graph IV B1

Answer (a) Graph .... [1]

(b) When the magnets are 4 cm apart, the force is 3 newtons. Find the equation connecting F and x.

$F = \dfrac{k}{x^2}$ M1

$3 = \dfrac{k}{4^2}$

$k = 48$

$F = \dfrac{48}{x^2}$ A1

Answer (b) .... [2]

(c) Find the distance between the two magnets when the force is 0.75 newtons.

$$F = \frac{48}{x^2}$$

$$0.75 = \frac{48}{x^2}$$

$$x^2 = \frac{48}{0.75}$$

$x = 8$ cm   or $x = -8$ (N.A.) | B1 for $x = 8$ |

Answer (c) .... cm [1]

---

14. The actual perimeter of a reservoir is 37 km. The perimeter of the reservoir is represented by a length of 185 cm on the map.

(a) Write down the scale of the map in the form of $1 : n$.

185 cm : 37 km

185 cm : 3700000 cm

1 : 20000 | B1 |

Answer (a) 1 : .... [1]

(b) A plantation has an actual area of 3.2 km². Find the area, in square centimeters, of the plantation on the map.

185 cm : 37 km

1 cm : 0.2 km

1 cm² : 0.04 km² | M1 |

Area on the map $= \dfrac{3.2}{0.04}$

$= 80$ cm² | A1 |

Answer (b) .... cm² [2]

---

15. When written as product of their prime factors,

$$P = 2^3 \times 3^6$$

$$Q = 2^3 \times 3 \times 5,$$

$$R = 2^2 \times 3^2 \times 5.$$

(a) Find the value of the cube root of P.

$$P = 2^3 \times 3^6$$

$$= \left(2 \times 3^2\right)^3$$

$$\sqrt[3]{P} = \sqrt[3]{\left(2 \times 3^2\right)^3}$$

$$= 18 \qquad \boxed{\text{B1}}$$

Answer (a) .... [1]

(b) Given that the HCF and LCM of Q, R and S is 60 and 2520 respectively, find the smallest possible value of S.

HCF $= 60 = 2^2 \times 3 \times 5$

LCM $= 2520 = 2^3 \times 3^2 \times 5 \times 7$ | M1 for either $60 = 2^2 \times 3 \times 5$ or $2520 = 2^3 \times 3^2 \times 5 \times 7$ |

$S = 2^2 \times 3 \times 5 \times 7$

$= 420$ | A1 |

Answer (b) .... [2]

---

16. Two containers are geometrically similar. The larger container has a capacity of 1.08 litres and the smaller container has a capacity of 0.32 litres. The height of the larger container is 18 cm.

(a) Calculate the height of the smaller container.

$$\left(\frac{h}{18}\right)^3 = \frac{0.32}{1.08}$$ M1

$$\left(\frac{h}{18}\right)^3 = \frac{8}{27}$$

$$\frac{h}{18} = \frac{2}{3}$$

$$h = 12 \text{ cm}$$ A1

Answer (a) .... cm [2]

(b) The ratio surface area of larger container : surface area of smaller container can be written in the form $k : 1$. Find the value of k.
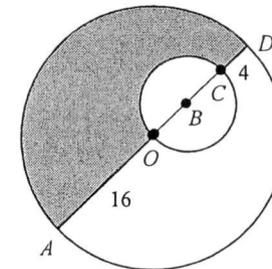
$$\left(\frac{3}{2}\right)^2 = \frac{9}{4}$$ M1

$$= \frac{\frac{9}{4}}{1}$$

$$\therefore \quad \text{Ratio} = 2.25 : 1$$

$$\therefore \quad k = 2.25$$ A1

Answer (b) $k =$ .... [2]

17.

(a) In the diagram, the big circle, centre O, has a radius of 16 cm. The small circle, centre B, has OC as diameter. $AOBCD$ is a straight line with $CD = 4$ cm. Find the perimeter of the shaded region, leaving your answer in terms of π.

Perimeter of shaded region

$$= \frac{1}{2}(2)(\pi)(16) + \frac{1}{2}(2)(\pi)(6) + 16 + 4$$ M1

$$= 16\pi + 6\pi + 20$$

$$= 22\pi + 20 \text{ cm}$$ A1

Answer (a) .... cm [2]

(b) A point is chosen, at random within the big circle. Find the probability that this point is in the shaded region.

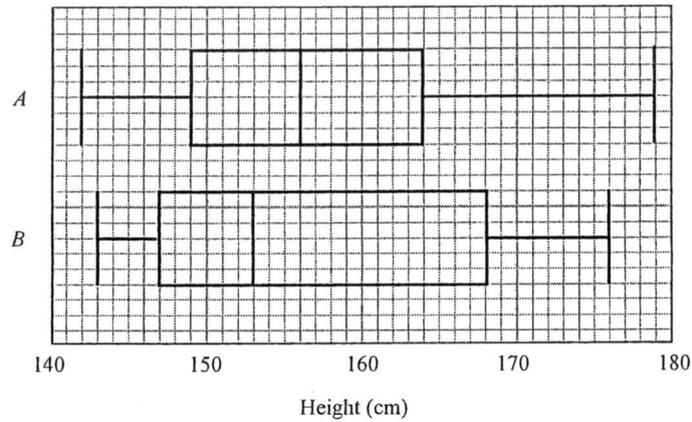P (point is in the shaded region)

$$= \frac{\frac{1}{2}(\pi)(16)^2 - \frac{1}{2}(\pi)(6)^2}{\pi(16)^2}$$ M1

$$= \frac{128\pi - 18\pi}{256\pi}$$

$$= \frac{55}{128}$$ A1

Answer (b) .... [2]

18. These box plots show the distributions of the heights of students in two schools A and B.

A

B

| 140 | 150 | 160 | 170 | 180 |

Height (cm)

(a) Find the median for school A.

Median $= 156$ cm   B1

Answer (a) .... cm [1]

(b) Find the interquartile range for school B.

Interquartile range $= 168 - 147$

$= 21$ cm   B1

Answer (b) .... cm [1]

(c) Here are two statements comparing the heights for the two schools.

For each one, write whether you agree or disagree. Give a reason for each answer.

(i) On average, students from school A is taller than students from school B.

Answer (c)(i) <u>Agree</u> because <u>the median height of the students from school A</u>
<u>is higher as compared to school B.</u>   B1

(ii) A greater proportion of the students has a height of more than 165 cm in school A than in school B.

Answer (c)(ii) <u>Disagree</u> because <u>less than 25% of the students has height of</u>

<u>more than 165 cm in school A but more than 25% of the</u>
<u>students has height of more than 165 cm in school B.</u>   B1

19. The step-function graph below shows the parking charges for the first 5 hours at Carpark P.

Answer (b)(i)

B1

Parking
Charges
($)

Duration
(hours)
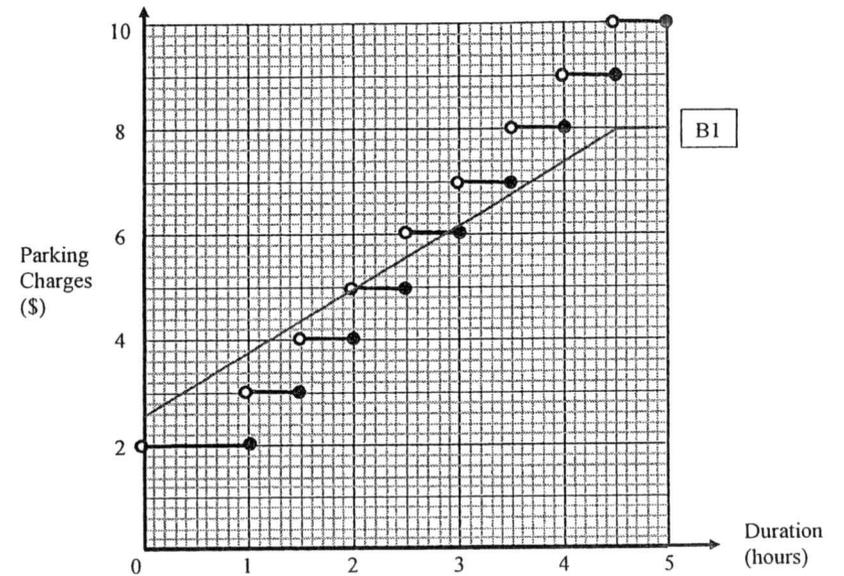
(a) Find the parking charges for a car that is parked at Carpark P for

(i) $1\frac{1}{2}$ hours,

$3   B1

Answer (a)(i) $ .... [1]

(ii) 3 hours 10 minutes.

$7   B1

Answer (a)(ii) $ .... [1]

22. A circle, centre O, passes through the points P, Q, R, S and T. QT is the diameter of the circle, angle $SOT = 70°$ and QR is parallel to OS.
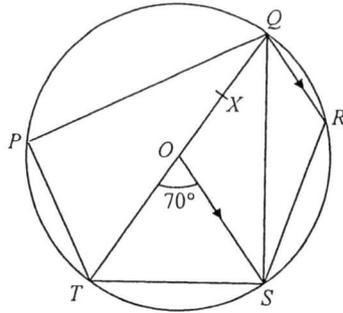
(a) Find

(i) angle OQS,

angle $OQS = 35°$ ($\angle$ at centre $= 2\angle$ at circumference)   B1

Answer (a)(i) angle $OQS =$................ [1]

(ii) angle OTS,

angle $OTS = \dfrac{180° - 70°}{2}$ (base $\angle$ s of isos. Δ)

$= 55°$ B1

Answer (a)(ii) angle $OTS =$................ [1]

(iii) angle QRS,

angle $QRS = 180° - 55°$ (opp. $\angle$ s of cyclic quad)

$= 125°$ B1

Answer (a)(iii) angle $QRS =$................ [1]

(iv) angle QSR,

angle $OSQ = 35°$ (base $\angle$ s of isos. Δ)

angle $SQR = 35°$ (alt. $\angle$ s)

angle $QSR = 180° - 35° - 125°$ ($\angle$ sum of Δ)

$= 20°$ B1

Answer (a)(ii) angle $QSR =$................ [1]

(b) X is the point on QT such that $QX = \dfrac{1}{4}QT$. Given that the area of triangle PQT is 90 cm^2, calculate the area of PXT.

$\dfrac{\text{Area of } \Delta PXT}{\text{Area of } \Delta PQT} = \dfrac{\frac{1}{2} \times XT \times h}{\frac{1}{2} \times QT \times h}$
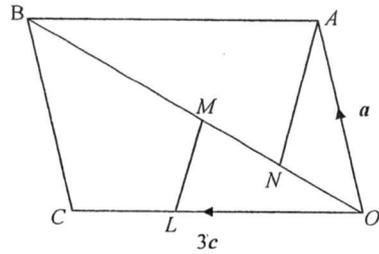
$\dfrac{\text{Area of } \Delta PXT}{90} = \dfrac{XT}{QT}$

$\dfrac{\text{Area of } \Delta PXT}{90} = \dfrac{3}{4}$ M1

Area of $\Delta PXT = \dfrac{3}{4} \times 90$

$= 67.5$ cm^2 A1

Answer (b) .... cm^2 [2]

23.

$OABC$ is a parallelogram. M is the midpoint of OB, N is the point on OM such that $OM = 2ON$ and L is the point on OC such that $OL = 2LC$. $\overrightarrow{OA} = a$, $\overrightarrow{OC} = 3c$ and $\overrightarrow{ML} = -\frac{1}{2}a + \frac{1}{2}c$.

(a) Write each of the following in terms of a and c. Give your answers in the simplest form.

(i) $\overrightarrow{OB}$

$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$

$\qquad = a + 3c \qquad$ B1

Answer (a)(i) .... [1]

(ii) $\overrightarrow{ON}$

$\overrightarrow{ON} = \frac{1}{4}\overrightarrow{OB}$

$\qquad = \frac{1}{4}(a + 3c) \qquad$ B1

Answer (a)(ii) .... [1]

(iii) $\overrightarrow{AN}$

$\overrightarrow{AN} = \overrightarrow{AO} + \overrightarrow{ON}$

$\qquad = -a + \frac{1}{4}(a + 3c) \qquad$ M1

$\qquad = -\frac{3}{4}a + \frac{3}{4}c \qquad$ A1

Answer (a)(iii) .... [2]

(b) Explain why ML is parallel to AN.

$\overrightarrow{AN} = -\frac{3}{4}a + \frac{3}{4}c \qquad$ and $\qquad \overrightarrow{ML} = \frac{1}{2}(-a + c)$

$\qquad = \frac{3}{4}(-a + c)$

$\overrightarrow{ML} = \frac{2}{3}\overrightarrow{AN}$

Answer (b) <u>Since $\overrightarrow{ML} = \frac{2}{3}\overrightarrow{AN}$, ML is parallel to AN.</u> $\qquad$ B1

Answer (b) ....

....

.... [1]

(c) Find the ratio $AN : ML$.

$AN : ML = 3 : 2 \qquad$ B1

Answer (c) .... [1]

End of Paper

Answer **all** questions.

1 (a) Simplify $\dfrac{5p^2-20}{3p^2+6p}$. [3]

(b) Express as a single fraction in its simplest form.

(i) $\dfrac{3xy^2}{16} \div \dfrac{15y}{4x}$ [2]

(ii) $\dfrac{7}{2x+1} - \dfrac{1}{x-2}$ [2]

(c) Solve the equation $\dfrac{8x-1}{x-2} - 3 = 2x$. [3]

(d) It is given that $ab = cd + 2bc^2$.

(i) Find a when $b = 0.8, c = 2$ and $d = -1$. [1]

(ii) Express b in terms of a, c and d. [2]

---

2 (a) The interior angle of a regular polygon is 160°.
Calculate the number of sides that the polygon has. [2]

(b) The diagram shows a parallelogram $ABCD$ with DA produced to E. F is the point of intersection of AB and CE.
Angle $AEF = (2x + 15)°$ and angle $ECB = (x + 30)°$.
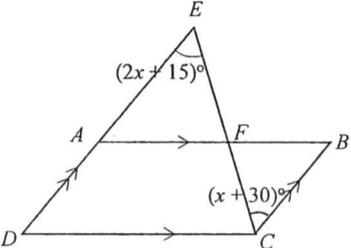
(i) Find the value of x. [2]
(ii) Show that triangles AEF and DEC are similar. [2]
(iii) Given that the length of $AF = 3$ cm, $CD = 5$cm and $AE = 4$ cm, find the length of AD. [2]

3 Mr Tan plans to organize a family outing to Singapore Zoo.
The cost of a ticket to Singapore Zoo is $22 for a child, $33 for an adult and $15 for a senior citizen if the ticket is bought at the entrance of the zoo.
If the ticket is bought online, there would be a discount and the ticket would cost $16.50 for a child, $24.75 for an adult and $11.25 for a senior citizen.

The information can be represented by the matrix $\mathbf{T} = \begin{pmatrix} 22 & 33 & 15 \\ 16.5 & 24.75 & 11.25 \end{pmatrix} \begin{matrix} \text{Entrance} \\ \text{Online} \end{matrix}$
with columns headed Child, Adult, Senior Citizen.

(a) Mr Tan's family consists of 5 children, 6 adults and 2 senior citizens.
Represent the number of people in Mr Tan's family in a 3×1 column matrix $\mathbf{P}$. [1]

(b) Evaluate the matrix $\mathbf{R} = \mathbf{TP}$. [2]

(c) State what the elements of $\mathbf{R}$ represent. [1]

(d) Evaluate the matrix $\mathbf{Q} = (1 \quad -1)\, \mathbf{R}$. [1]

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

---

4 The diagram shows part of a number grid.

2	4	6	8	10	12
14	16	18	20	22	24
26	28	30	32	34	36
38	40	42	44	46	48

A square outlining nine numbers, as shown, can be placed anywhere on the grid. n represents the number in the top left corner of the square.

(a) Write down an expression, in terms of n, for the number in the bottom right corner of the square. [1]

(b) Find the value of n given that the sum of the four numbers in all the corners of the square is 928. [2]

(c) Show that the difference between the products of the numbers in the diagonally opposite corners of the square is always 96. [2]

5 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, correct to two decimal places, are given in the table below.

x	0.5	1	2	3	4	5	5.5
y	−3.94	−4.75	−4.50	−3.42	p	0.45	1.74

(a) Find the value of p. [1]

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw a horizontal x-axis for $0 \le x \le 6$ and a vertical y-axis for $-5 \le y \le 2$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find the solutions of $\dfrac{x^2}{4} + \dfrac{1}{x} = 1\dfrac{1}{2}$ [2]

(d) By drawing a tangent, find the gradient of the curve at the point $(1, -4.75)$. [2]

(e) **(i)** On the same axes, draw the line $y = \dfrac{1}{2}x - 4$ for $0 \le x \le 6$. [2]

(ii) Write down the x-coordinate of the point where the line intersects the curve for $0.5 \le x \le 6$. [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]

6
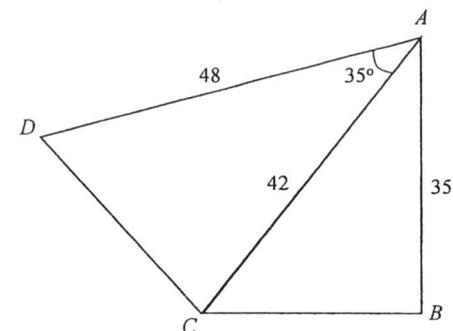
The diagram shows a field $ABCD$ on horizontal ground, crossed by a path AC.
B is due south of A and C is due west of B.
$AC = 42$ m, $AD = 48$ m and $AB = 35$ m.
Angle $DAC = 35°$.

(a) Calculate

(i) BC, [1]

(ii) CD, [3]

(iii) angle ADC, [2]

(iv) the area of the field, [2]

(v) the bearing of D from A. [2]

(b) A bird is at E, which is vertically above C.

The angle of elevation of E from A is 35°.

Calculate the angle of depression of D from E. [3]

7 (a) A group of 80 students took a Mathematics examination. The highest mark for the test is 100. The table below shows a summary of their marks.

Marks	Frequency
$0 < x \leq 20$	2
$20 < x \leq 40$	10
$40 < x \leq 60$	23
$60 < x \leq 80$	42
$80 < x \leq 100$	3

   (i) Calculate an estimate of
       (a) the mean mark, [2]
       (b) the standard deviation of the marks. [2]

   (ii) Explain why the mean and the standard deviation calculated is only an estimation. [1]

   (iii) The same group of students took a Science Examination and their results are summarized as follows.

| Mean mark	47
Standard deviation	8.3

   Make two comparisons between the performances of the students in the two examinations. [2]

   (iv) A student is chosen at random from the group. Find the probability that the student scored more than 60 marks in the Mathematics Examination. [1]

   (v) Two students are chosen at random from the group. Find the probability that both of them scored more than 20 marks but less than or equals to 60 marks in the Mathematics Examination. [2]

(b) The probability of passing an English Examination is 0.7 and the probability of passing a Mother Tongue Examination is 0.55.
A student is chosen at random from the same group of students.
Find the probability that the student will pass at least one examination. [2]

8 A watch dealer bought w watches, each at the same price, for a total cost of $4 725.

   (a) Find an expression, in terms of w, for the cost, in dollars, of each watch. [1]

   (b) The watch dealer kept 2 watches for himself and sold the rest at a profit of $150 per watch. Write down an expression, in terms of w, for the total amount he received for all the watches sold. [1]

   (c) Given that the watch dealer made a profit of $1320 altogether, form an equation in w and show that it reduces to $5w^2 - 54w - 315 = 0$. [3]

   (d) Solve the equation $5w^2 - 54w - 315 = 0$. [3]

   (e) Find the selling price of each watch. [2]

---

9 (a) The solid in the figure below is made up by extracting a circular cone of base diameter 12 cm and height 8 cm from a metal hemisphere of diameter 20 cm.
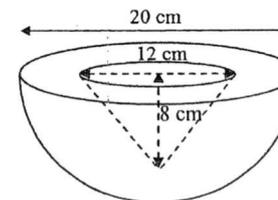
   Calculate
   (i) the volume of the figure, [3]
   (ii) the total surface area of the figure. [4]

   (b) The solid is melted and all of the metal was used to make some cubes.

   What is the maximum number of cubes that can be made if the length of each cube is 3 cm? [2]

10 AirSinga is a budget airline that charges passengers for checked baggage and excess baggage. The information on the cost of checked baggage and excess baggage for International Flights and Domestic Flights is given in the table below.

Cost of checked baggage for a round-trip ticket during the initial booking of International Flights

Weight of baggage	Price
Up to 20 kg	$35
Up to 40 kg	$112

Cost of checked baggage for a round-trip ticket during the initial booking of Domestic Flights

Weight of baggage	Price
Up to 15 kg	$13
Up to 30 kg	$30

Excess baggage for any flights after initial booking has been made

$22 per kg or part thereof

(a) Miss Lynn and Miss Sonia bought a round-trip ticket with AirSinga from Bangkok to Phuket. Each of them paid for checked baggage up to 15 kg for their initial booking of the domestic flight. When they left Bangkok, the weight of their baggage was 11 kg each. On their return trip, Miss Lynn's baggage weighed 8.5 kg more than the initial weight of her baggage and Miss Sonia's baggage weighed 2 kg more than the initial weight of her baggage. If Miss Lynn and Miss Sonia combined the weight of their baggage on the return trip, how much would Miss Lynn have to pay for her excess baggage? [2]

(b) Mr Willy bought a round-trip ticket from Singapore to Taiwan. He paid for checked baggage up to 20 kg during his initial booking for the International Flight. The weight of his baggage was 15 kg when he left Singapore. On his return trip, his baggage weighed 24 kg and hence, he was charged for the excess baggage. Should Mr Willy pay for checked baggage up to 20 kg or 40 kg during his initial booking to save money? Justify your decision with calculations, indicating the amount of money saved. [4]

(c) Mr Hassan wants to travel to Hong Kong and did a research on the cost of the air tickets of two airline companies, Air Singa and Singapura Airline. Some of the information is shown in the tables below.
Singapura Airline does not charge passengers for checked baggage, up to 30 kg.
The time indicated in the tables is the time of departure.

Cost of Air Singa's air tickets from Singapore to Hong Kong, including all taxes

Time \ Date	1 June	2 June	3 June	4 June	5 June	6 June	7 June
6 am	$150	$150	$180	$180	$140	$140	$150
4 pm	$160	$165	$180	$180	$135	$135	$135

Cost of Air Singa's air tickets from Hong Kong to Singapore, including all taxes

Time \ Date	1 June	2 June	3 June	4 June	5 June	6 June	7 June
11 am	$145	$160	$200	$200	$150	$150	$160
9 pm	$130	$180	$200	$200	$170	$180	$190

Cost of Singapura Airline's air tickets from Singapore to Hong Kong, including all taxes

Time \ Date	1 June	2 June	3 June	4 June	5 June	6 June	7 June
5 am	$200	$190	$275	$300	$200	$200	$220
3 pm	$180	$225	$275	$275	$180	$180	$200

Cost of Singapura Airline's air tickets from Hong Kong to Singapore, including all taxes

Time \ Date	1 June	2 June	3 June	4 June	5 June	6 June	7 June
10 am	$200	$220	$260	$280	$220	$230	$230
10 pm	$190	$220	$260	$260	$200	$220	$220

Mr Hassan would like to stay in Hong Kong for 6 days 5 nights and he has the flexibility to travel between 1 June and 7 June. He would like to depart from Singapore in the morning and depart from Hong Kong at night. He also wants to travel with the same airline for both trips.

Which airline should Mr Hassan choose to get the cheapest option given that his checked baggage for both trips was 24 kg? Justify your decision with calculations, indicating the date and time of the flights that he should choose. [5]

Marking Scheme

1. (a) $\dfrac{5p^2-20}{3p^2+6p} = \dfrac{5(p^2-4)}{3p(p+2)}$ [M1: $5(p^2-4)$ or $3p(p+2)$]

    $= \dfrac{5(p+2)(p-2)}{3p(p+2)}$ [M1: $(p+2)(p-2)$]

    $= \dfrac{5(p-2)}{3p}$ [A1: Accept $\dfrac{5p-10}{3p}$]

b(i) $\dfrac{3xy^2}{16} \div \dfrac{15y}{4x}$

    $= \dfrac{3xy^2}{16} \times \dfrac{4x}{15y}$ [M1]

    $= \dfrac{x^2y}{20}$ [A1]

b(ii) $\dfrac{7}{2x+1} - \dfrac{1}{x-2}$

    $= \dfrac{7(x-2) - 1(2x+1)}{(2x+1)(x-2)}$ [M1: Attempt to make common denominator]

    $= \dfrac{5x-15}{(2x+1)(x-2)}$ [A1: Accept $\dfrac{5x-15}{2x^2-3x-2}$]

(c) $\dfrac{8x-1}{x-2} = 2x+3$

    $8x-1 = (2x+3)(x-2)$
    $8x-1 = 2x^2 - x - 6$ [M1: Expanded correctly]
    $2x^2 - 9x - 5 = 0$ [M1]
    $(2x+1)(x-5) = 0$
    $x = -0.5/-\dfrac{1}{2}$ or $x = 5$ [A1: both values of x are correct]

d(i) $a = 5.5 \;/\; 5\tfrac{1}{2} \;/\; \tfrac{11}{5}$ [B1]

d(ii) $ab = cd + 2bc^2$
    $ab - 2bc^2 = cd$
    $b(a - 2c^2) = cd$ [M1: took out common factor b]
    $b = \dfrac{cd}{a - 2c^2}$ [A1]

2

2. (a) Method 1:
    Exterior angle $= 20^\circ$ [M1]
    Number of sides $= \dfrac{360}{20}$
                  $= 18$ [A1]

    Method 2:
    $(n-2)(180) = 160n$ [M1]
    $180n - 360 = 160n$
    $20n = 360$
    $n = 18$ [A1]

(i) $2x + 15 = x + 30$ [M1]
    $x = 15$
    Angle $AEF = 45^\circ$ [A1]

(ii) Angle $AEF =$ Angle DEC (common angle)   [M1: one correct statement with reason]
    Angle $EAF =$ Angle EDC (Corresponding angle)
    $\therefore$ Triangles AEF and DEC are similar (AA Similarity test)   [A1]

(iii) Using similar triangles:
    $\dfrac{DE}{4} = \dfrac{5}{3}$ [M1]
    $DE = \dfrac{20}{3}$ cm
    $\therefore AD = \dfrac{20}{3} - 4$
    $= 2\tfrac{2}{3}/\tfrac{8}{3}/2.67$ cm (3 s.f.)   [A1]

3. (a) $\mathbf{P} = \begin{pmatrix} 5 \\ 6 \\ 2 \end{pmatrix}$ [B1]

(b) $\mathbf{R} = \begin{pmatrix} 22 & 33 & 15 \\ 16.5 & 24.75 & 11.25 \end{pmatrix} \begin{pmatrix} 5 \\ 6 \\ 2 \end{pmatrix}$

    $= \begin{pmatrix} 338 \\ 253.5 \end{pmatrix}$ [B1: 338] [B1: 253.5]

(c) The elements of $\mathbf{R}$ represent the total amount that Mr Tan has to pay for the tickets for his family if the tickets are bought at the entrance and online respectively.   [B1]

(d) $\mathbf{Q} = (1 \;\; -1) \begin{pmatrix} 338 \\ 253.5 \end{pmatrix}$
    $= (84.5)$ [B1: Allow ecf from (b)]

(e) $\mathbf{Q}$ represents the total amount that Mr Tan would save if he has bought the tickets online.   [B1]

4. (a) $n + 28$ [B1]

(b) $n + (n+4) + (n+24) + (n+28) = 928$ [M1]
    $4n + 56 = 928$
    $n = 218$ [A1]

(c) $(n+4)(n+24) - n(n+28)$ [M1: accept $n(n+28) - (n+4)(n+24)$]
    $= (n^2 + 28n + 96) - n^2 + 28n$
    $= 96$ [A1: accept -96]

5(a) B1: $p = -1.75$

(b) P1: Plot 5 points correctly
P1: Plot 2 other points correctly with correct scale
C1: Smooth curve

(c) M1: Ruled straight line through $(2, -4.5)$ or $y = -4.5$ seen.
A1 or B1: $x = 2$ or $x = 0.75(\pm 0.1)$

(d) M1: Attempt to draw a tangent at $(1, -4.75)$.
A1: Gradient $= -0.5(\pm 0.1)$

(e)i B1: Attempted to draw and labelled $y = \frac{1}{2}x - 4$ or table of values seen

B1 or B2: Drew $y = \frac{1}{2}x - 4$ correctly

(e)ii B1: $x = 3.8(\pm 0.1)$

(e)iii $\frac{x^2}{4} + \frac{1}{x} - 6 = \frac{1}{2}x - 4$ [M1]
$x^3 - 2x^2 - 8x + 4 = 0$
$\therefore A = -2, B = -8$ [A1]

6(a)(i) $BC = \sqrt{42^2 - 35^2}$
$= \sqrt{539}$
$= 23.2$ m (3 s.f.) [B1]

(a)(ii) Using the cosine rule,
$(CD)^2 = 48^2 + 42^2 - 2(48)(42)\cos 35$ [M1: Substituted correct values into cosine rule]
$= \sqrt{765.1789574}$ [M1]
$CD = 27.66186829$
$= 27.7$ m (3s.f.) [A1]

(a)(iii) Using the sine rule,
$\frac{\sin \angle ADC}{42} = \frac{\sin 35}{27.66186829}$ [M1: Applied sine rule correctly; Allow ECF from (ii)]

$\angle ADC = 60.56124173$
$= 60.6°$ (1 d.p.) [A1]

(a)(iv) Area of the field
$= \frac{1}{2}(48)(42)\sin 35 + \frac{1}{2}(\sqrt{539})(35)$ [M1: Either $\frac{1}{2}(48)(42)\sin 35$ OR $\frac{1}{2}(\sqrt{539})(35)$]
$= 984.4515847$
$= 984$ m² (3 s.f.) [A1]

(a)(v) $\cos \angle CAB = \frac{35}{42}$ [M1: Attempted to use trigo ratios to find $\angle CAB$]
$\angle CAB = 33.55730976°$
Bearing of D from A
$= 180 + 33.55730976 + 35$
$= 248.6°$ (1 d.p.) [A1]

(b) $\tan 35 = \frac{EC}{42}$ [M1]
$EC = 42 \tan 35$
$\tan \angle EDC = \frac{42 \tan 35}{27.66186829}$ [M1: allow ecf for value of CD from a(ii)]

$\angle EDC = 46.8°$ (1 d.p)
$\therefore$ Angle of depression $= 46.8°$ [A1]

7(a)(i)(a) Mean $= \frac{2(10)+10(30)+23(50)+42(70)+3(90)}{80}$ [M1]

$= 58.5 \, / 58\frac{1}{2}$ [A1]
[Note: Award only B1 if no working is shown]

(a)(ii)(b) Standard deviation of the marks

$= \sqrt{\frac{296800}{80} - \left(58\frac{1}{2}\right)^2}$ [M1: Correct substitution]

$= 17.0$ (3 s.f.) [A1]
[Note: Award only B1 if no working is shown]

(a)(ii) The exact mark of each student is not known. [B1]

(a)(iii) The students did better in the Math exam as the mean mark of the Math exam is higher. [B1]
However, the result of the Science exam is more consistent as the standard deviation of the marks of the Science exam is lower. [B1]

(a)(iv) $\frac{45}{80} = \frac{9}{16} / 0.5625$ [B1]

(a)(v) $\frac{33}{80} \times \frac{32}{79}$ [M1]
$= \frac{66}{395} / 0.167$ (3s.f.) [A1]

(b) $(0.55 \times 0.7) + (0.55 \times 0.3) + (0.45 \times 0.7)$ [M1: Accept $1 - 0.3(0.45)$]
$= \frac{173}{200} / 0.865$ [A1]

8 (a) $\$\frac{4725}{w}$ [B1]

(b) $\$(w - 2)(\frac{4725}{w} + 150)$ [B1]

(c) $(w - 2)\left(\frac{4725}{w} + 150\right) = 4725 + 1320$ [M1: Formed the correct equation]

$4725 + 150w - \frac{9450}{w} - 300 = 6045$ [M1: Correct expansion]

$150w^2 - 1620w - 9450 = 0$
$5w^2 - 54w - 315 = 0$ (shown) [A1]

(d) $5w^2 - 54w - 315 = 0$

Using the general formulae,

$w = \dfrac{-(-54) \pm \sqrt{(-54)^2 - 4(5)(-315)}}{2(5)}$ OR $(w - 15)(5w + 21) = 0$

[M1: Correct substitution OR factorized correctly]

$w = 15$ or $w = -4.2 \; / -4\frac{1}{5} \; / -\frac{21}{5}$

[A2: minus 1 mark if students reject any of the answers]

*Award only B2 if students got both values of w correct without showing working

(e) Selling price $= \dfrac{4725}{15} + 150$
$= \$465$

[M1: $\frac{4725}{15}$ (allow ecf for M1)]

[A1]

9(a)(i) Volume of the figure
$= \dfrac{2}{3}\pi(10)^3 - \dfrac{1}{3}\pi(6)^2(8)$
$= 1792.802208$ cm³
$= 1790$ cm³ (3 s.f.)

[M1: attempted to find the vol. of hemisphere or cone]
[M1: attempted to subtract the vol. of cone from vol. of hemisphere]
[A1]

(a)(ii) Slant height of the cone
$= \sqrt{6^2 + 8^2}$
$= 10$ cm
Total surface area of the cone
$= 2\pi(10)^2 + \pi(6)(10) + [\pi(10)^2 - \pi(6)^2]$
$= 1020$ cm² (3 s.f.)

[M1: Attempted to find slant height of the cone]
[M1: Found 1 of the 3 S.A. correctly]
[M1: Found the other 2 S.A. correctly]
[A1]

(b) Max number of cubes
$= \dfrac{1792.802208}{3^3}$
$= 66$

[M1: Allow ECF from (i)]

[A1]

10(a) Excess baggage weight
$= 8.5 - 4 - 2$ [M1]
$= 2.5$ kg
Amount paid for excess baggage
$= 3 \times 22$
$= \$66$ [A1]

(b) Amount that he has to pay for the excess baggage   [M1: Identified that excess baggage = 4kg]
$= 4 \times 22$
$= \$88$
Total amount spent with checked baggage up to 20kg   [M1: Attempted to find total amount spent with checked baggage up to 20kg]
$= \$88 + \$35$
$= \$123$
Total amount saved with checked baggage up to 40kg   [M1: Attempted to find the amount saved]
$= 123 - 112$
$= \$11$ [A1: Indicated the decision clearly stating the amount of money saved]
∴ Mr Willy should pay for checked baggage up to 40kg during his initial booking as he would save $11.

(c) To travel for 6D5N, there are only 2 options:
1 – 6 June or 2 – 7 June

Air ticket for Air Singa for 1 June, 6am to 6 June, 9pm + checked baggage up to 40 kg
$= \$150 + \$180 + \$112$ [M1]
$= \$442$ [A1]

Air ticket for Singapura Airline for 2 June, 5am to 7 June, 10pm
$= \$190 + 220$ [M1]
$= \$410$ [A1]

Therefore, Mr Willy should buy the air ticket from Singapura Airline, choosing the departure flight on 2 June at 5am and the arrival flight on 7 June at 10pm.   [A1]