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Name

Reg. No

Class



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2EX

MATHEMATICS

[80 marks]

SEMESTER ONE EXAMINATION

Thursday, 14 May 2015

2 hours

Candidates answer on the Question Paper for section A

Additional material: Electronic Calculator
Geometrical Instruments
Answer Paper

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, register number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **ALL** questions.

For **Section A**, write your answers in the spaces provided on the question paper.

For **Section B**, write your answers in the spaces on the separate answer paper provided.

If working is needed for any question, it must be shown with the answer.

Omission of essential working will result in loss of marks.

Write the brand and model of your calculator in the space provided below.

INFORMATION FOR CANDIDATES

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

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 .

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**.

Brand & Model of Calculator

For Examiner's Use	
Section A	40
Section B	40
Total	80

This question paper consists of 12 printed pages.

Setter: Mr. Gabriel Cheow

Vetter: Mr. Chio Kah Leong

For
Examiner's
Use

Section A (40 marks)

For
Examiner's
Use

Answer **all** the questions.

- 1** A map is drawn to a scale of 1 : 25 000.

(a) This scale represents 1 cm : n km. Find n .

Answer (a) $n = \dots\dots\dots$ [1]

- (b)** The distance between two towns on the map is 30 cm.
Find the actual distance, in kilometres, between the two towns.

Answer (b) $\dots\dots\dots$ km [1]

- (c)** A lake has an actual area of 2.5 km^2 .
Find the area, in square centimetres, of the lake on the map.

Answer (c) $\dots\dots\dots \text{ cm}^2$ [2]

[Turn over

For
Examiner's
Use

- 2 y is directly proportional to x^3
It is also given that $y = 24$ when $x = 2$.

(a) Find the equation connecting y and x .

Answer (a) [2]

(b) Hence, find the value of y when $x = 3$.

Answer (b) [1]

- 3 The force of attraction, F newtons, between two magnets is inversely proportional of the square of the distance, d centimetres, between them.

When the magnets are at a certain distance apart, the force is 1.25 newtons.

Find the force when the distance is halved.

Answer newtons [2]

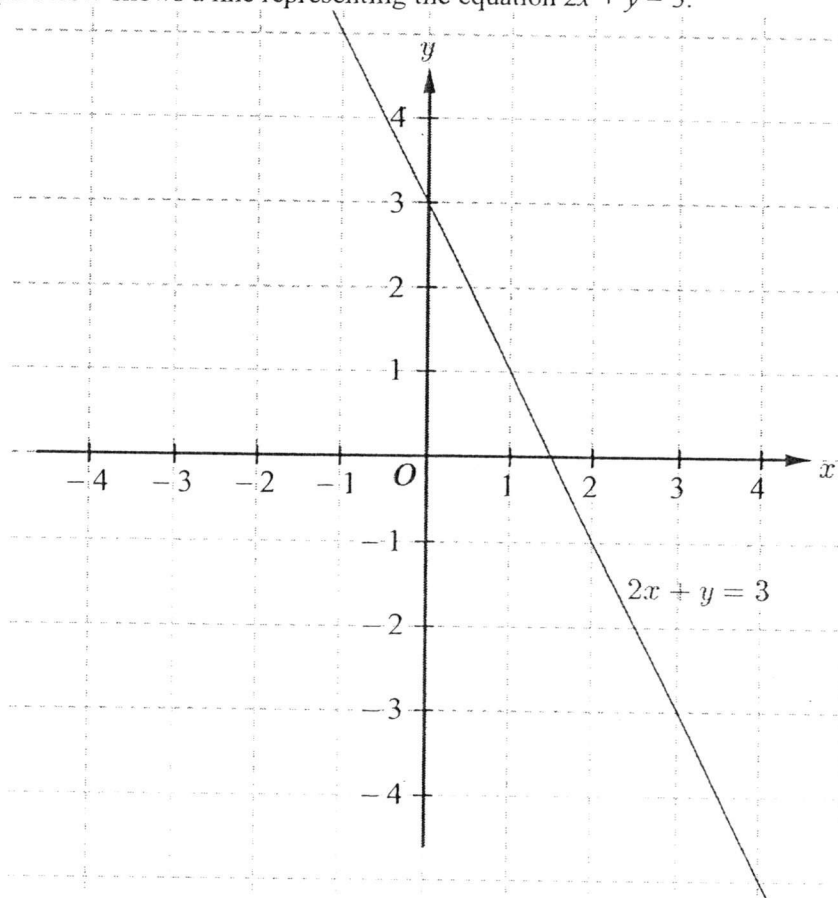
For
Examiner's
Use

70

[Turn over

For
Examiner's
Use

- 4 The graph below shows a line representing the equation $2x + y = 3$.

For
Examiner's
Use

- (a) Draw and label the line representing the equation $y = \frac{1}{2}x - 2$ on the same diagram above. [1]

- (b) Hence, solve the simultaneous linear equation.

$$2x + y = 3$$

$$y = \frac{1}{2}x - 2$$

Answer (b) $x = \dots\dots\dots$, $y = \dots\dots\dots$ [1]

- (c) Write down the equation of a line that passes through the origin and is parallel to the line $2x + y = 3$.

Answer (c) $y = \dots\dots\dots$ [2]

For
Examiner's
Use

5 Solve the following equations

(a) $2(x+3) - 5(1-x) = 7$,

(b) $\frac{x-2}{2x+1} = \frac{1}{4}$.

Answer (a) $x = \dots\dots\dots$ [2]Answer (b) $x = \dots\dots\dots$ [2]6 (a) Factorise $x^2 + 5x - 6$.Answer (a) $\dots\dots\dots$ [2](b) Hence, using your result in (a), factorise $(y-4)^2 + 5(y-4) - 6$.Answer (b) $\dots\dots\dots$ [1]

71

[Turn over

For
Examiner's
Use

For
Examiner's
Use

7 Solve the following simultaneous linear equation.

$$3x - 2y = 8$$

$$4x + 3y = 5$$

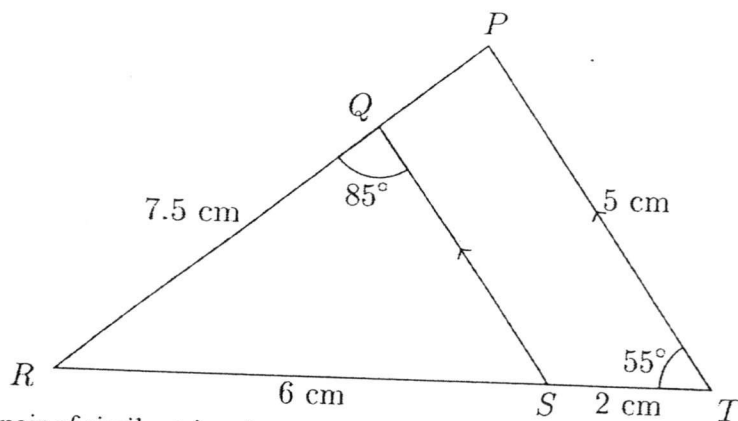
For
Examiner's
Use

Answer $x = \dots\dots\dots$, $y = \dots\dots\dots$ [3]

[Turn over

For
Examiner's
Use

- 8 In the diagram below, line TP is parallel to line SQ , QR is 7.5 cm, RS is 6 cm, ST is 2 cm and TP is 5 cm, $\angle RQS = 85^\circ$ and $\angle RTP = 55^\circ$.

For
Examiner's
Use

- (a) Name a pair of similar triangles.

Answer (a) Δ and Δ [1]

- (b) Find $\angle PRT$.

Answer (b) $\angle PRT =$ $^\circ$ [2]

- (c) Find the length of SQ .

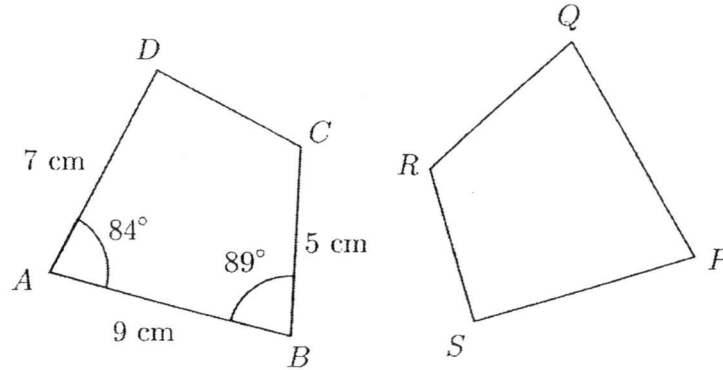
Answer (c) $SQ =$ cm [2]

- (d) Find $\frac{\text{area of } \Delta PRT}{\text{area of } \Delta RQS}$.

Answer (d) [2]

For
Examiner's
Use

- 9 The quadrilaterals $ABCD$ and $PQRS$ are congruent (not drawn to scale).



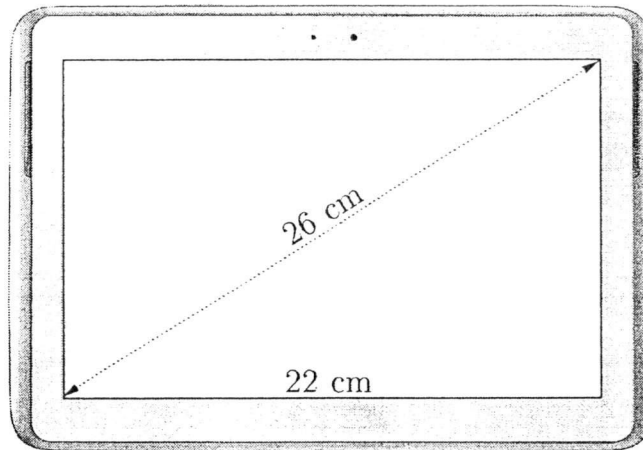
- (a) Write down the length of PQ .

Answer (a) $PQ = \dots\dots\dots$ cm [1]

- (b) Write down $\angle PQR$.

Answer (b) $\angle PQR = \dots\dots\dots^\circ$ [1]

- 10 The figure below is an electronic tablet.
Some of the dimensions for its rectangular screen are shown below.



Find the height of the screen.

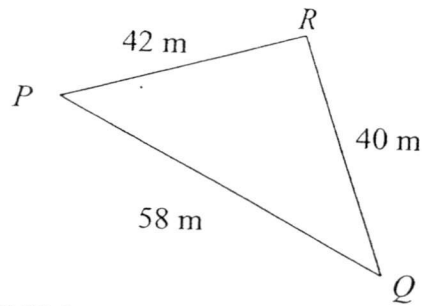
Answer $\dots\dots\dots$ cm [2]

For
Examiner's
Use

[Turn over

For
Examiner's
UseFor
Examiner's
Use

- 11 The diagram shows a triangular piece of land PQR with the dimensions $PQ = 58$ m, $QR = 40$ m and $RP = 42$ m.



- (a) Prove that triangle PQR is a right-angled triangle.

- (b) Find the area of the piece of land.

[2]

Answer (b) m² [2]

- (c) Find the shortest distance from R to PQ .

Answer (c) m [2]

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[Turn over

Section B (40 marks)

Answer **all** the questions on the separate answer paper provided.

12 Expand and simplify the following

(a) $2(x^2 - 3x + 2) - 3(x^2 + x - 2)$, [1]

(b) $(2x - 3)(x^2 - 2x - 4)$, [2]

(c) $3x^2 + 1 - 2(x + 1)^2$. [3]

13 (a) (i) Expand $(a - b)^2$. [1]

(ii) Hence, using your result in (a)(i), evaluate 98^2 . [2]

(b) If $(x - y)^2 = 57$ and $xy = 4$, find the value of $(x + y)^2$. [2]

14 Factorise the following completely

(a) $2n^2 - 18$, [2]

(b) $pq - 2q + 2 - p$. [2]

[Turn over

- 15 Express the following as a single fraction in its simplest form

(a) $\frac{4}{3x} + \frac{1}{2+x}$, [2]

(b) $\frac{3xy^3}{8z^2} \div \frac{9y^2}{10xz}$, [2]

(c) $\frac{3}{2x-1} - \frac{6x-1}{(2x-1)^2}$. [3]

16 (a) Express $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x}$ as a single fraction. [2]

(b) Hence, or otherwise, solve the equation $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x} = 5$. [2]

17 It is given that $Q = \sqrt{\frac{3P-1}{2P+1}}$.

(a) If $P = 2$, find the value of Q . [2]

(b) Make P the subject of the formula. [3]

(c) Hence, or otherwise, find the value of P when $Q = 2$. [2]

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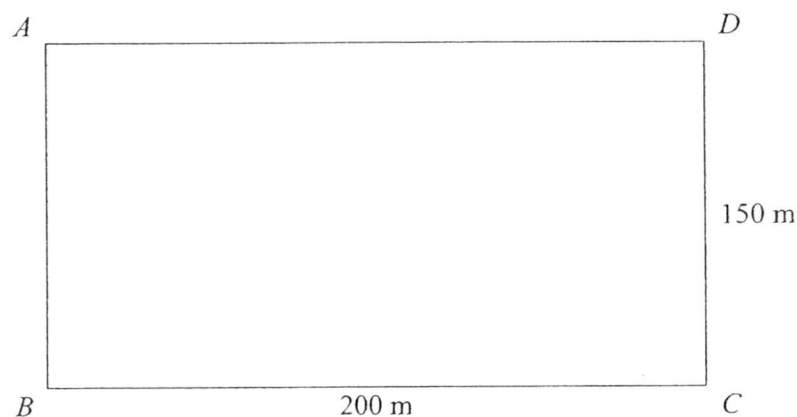
[Turn over

- 18 The time taken, t minutes, to pack all the Examination Care Packs is inversely proportional to the number of students, N , involved in the packing.

If a team of 3 students take 50 minutes to pack all the Examination Care Packs, how many **more** students are needed if the packing must be completed 20 minutes earlier?

[3]

-
- 19 The diagram below shows a rectangular field $ABCD$ (not drawn to scale) with dimensions 200 m by 150 m.



- (a) Find the distance from point A to point C . [2]
- (b) Mr. Cheow bought a new remote-controlled helicopter drone, and wants to fly it by standing at point A . The remote control has a maximum range of 225 m. Can the maximum range cover the whole field from where he stands? Explain why.

[2]

Name

MARK SCHEME

Reg. No

Class



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2EX**MATHEMATICS**

[80 marks]

SEMESTER ONE EXAMINATION

Thursday, 14 May 2015

2 hours

Candidates answer on the Question Paper for section A

Additional material: Electronic Calculator
 Geometrical Instruments
 Answer Paper

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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**.

Brand & Model of Calculator

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For Examiner's Use

Section A	40
Section B	40
Total	80

This question paper consists of 13 printed pages.

Setter: Mr. Gabriel Cheow

Vetter: Mr. Chio Kah Leong

75

For
Examiner's
Use**Section A (40 marks)**For
Examiner's
UseAnswer **all** the questions.

- 1 A map is drawn to a scale of 1: 25 000.

- (a) This scale represents 1 cm : n km. Find n .

$$\begin{aligned} 1: 25000 &= 1 \text{ cm} : 25000 \text{ cm} \\ &= 1 \text{ cm} : 250 \text{ m} \\ &= 1 \text{ cm} : 0.25 \text{ km} \end{aligned}$$

Answer (a) $n = 0.25 \dots$ [B1] [1]

- (b) The distance between two towns on the map is 30 cm.
Find the actual distance, in kilometres, between the two towns.

$$\begin{aligned} 1 \text{ cm} &: 0.25 \text{ km} \\ &= 30 \text{ cm} : 30 \times 0.25 \text{ km} \\ &= 30 \text{ cm} : 7.5 \text{ km} \end{aligned}$$

Answer (b) 7.5 ... [B1] km [1]

- (c) A lake has an actual area of 2.5 km^2 .
Find the area, in square centimetres, of the lake on the map.

$$\begin{aligned} \text{Ratio of area} &= \text{square of map scale} \\ &= (1 \text{ cm})^2 : (0.25 \text{ km})^2 \\ &= 1 \text{ cm}^2 : 0.0625 \text{ km}^2 \dots \dots \dots \text{ [M1]} \\ &= 16 \text{ cm}^2 : 1 \text{ km}^2 \\ &= 2.5 \times 16 \text{ cm}^2 : 2.5 \text{ km}^2 \\ &= 40 \text{ cm}^2 : 2.5 \text{ km}^2 \end{aligned}$$

Answer (c) 40 ... [A1] cm^2 [2]

For
Examiner's
UseFor
Examiner's
Use

- 2 y is directly proportional to x^3
It is also given that $y = 24$ when $x = 2$.

(a) Find the equation connecting y and x .

$$y \propto x^3$$

$$y = kx^3$$

$$24 = k(2)^2$$

$$24 = 8k$$

$$k = 3 \dots \dots \dots [M1]$$

$$\therefore y = 3x^3$$

Answer (a) $y = 3x^3 \dots [A1] [2]$

(b) Hence, find the value of y when $x = 3$.

$$\text{Let } x = 3 \text{ in } y = 3x^3$$

$$y = 3(3)^3$$

$$= 81$$

Answer (b) 81 ... [B1] [1]

- 3 The force of attraction, F newtons, between two magnets is inversely proportional of the square of the distance, d centimetres, between them.

When the magnets are at a certain distance apart, the force is 1.25 newtons.

Find the force when the distance is halved.

$$F \propto \frac{1}{d^2}$$

$$F = \frac{k}{d^2}$$

$$\text{When } d = a, F = 1.25$$

$$1.25 = \frac{k}{a^2}$$

$$\text{When } d = \frac{1}{2}a,$$

$$F = \frac{k}{\left(\frac{1}{2}a\right)^2} \dots \dots [M1]$$

$$= \frac{k}{\frac{1}{4}a^2}$$

$$= 4 \times \frac{k}{a^2}$$

$$= 4 \times 1.25$$

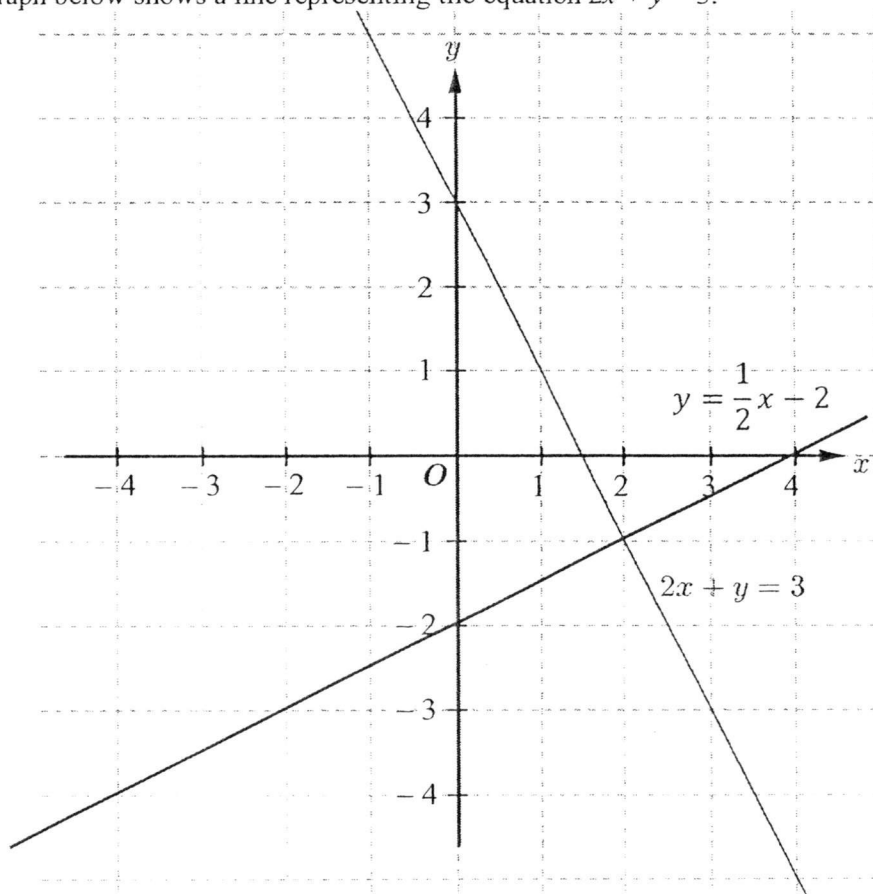
$$= 5$$

Answer 5 ... [A1] newtons [2]

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For
Examiner's
UseFor
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Use

- 4 The graph below shows a line representing the equation $2x + y = 3$.



- (a) Draw and label the line representing the equation $y = \frac{1}{2}x - 2$ on the same diagram above. [1]

- (b) Hence, solve the simultaneous linear equation.

$$2x + y = 3$$

$$y = \frac{1}{2}x - 2$$

Answer (b) $x = 2$, $y = -1$ (both x and y must be correct for B1) [1]

- (c) Write down the equation of a line that passes through the origin and is parallel to the line $2x + y = 3$.

$$\begin{aligned} 2x + y &= 3 \\ y &= -2x + 3 \dots \dots [M1] \\ \therefore m &= -2, c = 0 \end{aligned}$$

Answer (c) $y = -2x \dots [A1] [2]$

For
Examiner's
Use

5 Solve the following equations

(a) $2(x+3) - 5(1-x) = 7,$

$$2(x+3) - 5(1-x) = 7$$

$$2x + 6 - 5 + 5x = 7$$

$$7x + 1 = 7 \dots \dots [M1]$$

$$7x = 6$$

$$x = \frac{6}{7}$$

$$\text{Answer (a)} \ x = \frac{6}{7} \dots [A1] [2]$$

(b) $\frac{x-2}{2x+1} = \frac{1}{4}$

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

$$4(x-2) = 2x+1 \dots \dots [M1]$$

$$4x - 8 = 2x + 1$$

$$4x - 2x = 8 + 1$$

$$2x = 9$$

$$x = \frac{9}{2} \text{ or } 4\frac{1}{2} \text{ or } 4.5$$

$$\text{Answer (b)} \ x = \frac{9}{2} \text{ or } 4\frac{1}{2} \text{ or } 4.5 \dots [A1] [2]$$

6 (a) Factorise $x^2 + 5x - 6$.

Correct factorisation using cross method or multiplication frame [M1]

$$\text{Answer (a)} \ (x+6)(x-1) [A1 \text{ or } B2] [2]$$

(b) Hence, using your result in (a), factorise $(y-4)^2 + 5(y-4) - 6$.

$$\begin{aligned} \text{Let } x &= y-4 \\ (y-4)^2 + 5(y-4) - 6 &= (y-4+6)(y-4-1) \\ &= (y+2)(y-5) \end{aligned}$$

[B1 when both working shows result in (a) used and answer is correct]

$$\text{Answer (b)} \ (y+2)(y-5) [1]$$

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For
Examiner's
Use

7 Solve the following simultaneous linear equation.

For
Examiner's
Use

$$3x - 2y = 8$$

$$4x + 3y = 5$$

$$3x - 2y = 8 \dots\dots\dots (1)$$

$$4x + 3y = 5 \dots\dots\dots (2)$$

$$\text{From (1): } -2y = -3x + 8$$

$$2y = 3x - 8$$

$$y = \frac{3}{2}x - 4 \dots\dots\dots (3)$$

[M1 for showing the substitution method, or successfully eliminated x or y]

Substitute (3) into (2):

$$4x + 3\left(\frac{3}{2}x - 4\right) = 5$$

$$4x + \frac{9}{2}x - 12 = 5$$

$$\frac{17}{2}x = 17$$

$$x = 2$$

Substitute $x = 2$ into (1):

$$3(2) - 2y = 8$$

$$6 - 2y = 8$$

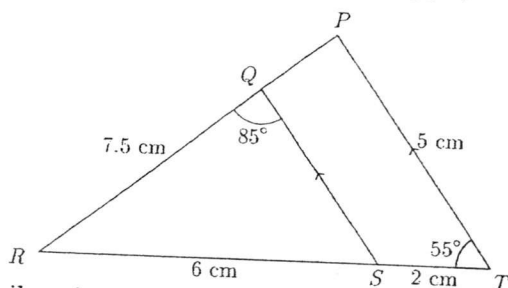
$$-2y = 2$$

$$y = -1$$

Answer $x = 2$ [A1], $y = -1$ [A1] [3]

For
Examiner's
Use

- 8 In the diagram below, line TP is parallel to line SQ , QR is 7.5 cm, RS is 6 cm, ST is 2 cm and TP is 5 cm, $\angle RQS = 85^\circ$ and $\angle RTP = 55^\circ$.



- (a) Name a pair of similar triangles.
[B1 for a naming the correct pair, with vertices in the correct order]
Other answers:
RSQ & RTP, SQR & TPR, SRQ & TRP, QRS & PRT, QSR & PTR

Answer (a) ΔRQS and ΔRPT [1]

- (b) Find $\angle PRT$.

$$\begin{aligned}\angle TPR &= \angle SQR \\ &= 85^\circ \\ \angle PRT &= 180^\circ - \angle TPR - \angle PTR \\ &= 180^\circ - 85^\circ - 55^\circ \dots \dots \dots [M1] \\ &= 40^\circ\end{aligned}$$

Answer (b) $\angle PRT = 40 \dots [M1]^\circ$ [2]

- (c) Find the length of SQ .

$$\begin{aligned}\text{Scale factor} &= \frac{RS}{RT} = \frac{6}{8} \dots \dots \dots [M1] \\ SQ &= \frac{6}{8} \times 5 \\ &= 3.75\end{aligned}$$

Answer (c) $SQ = 3.75 \dots [A1]$ cm [2]

- (d) Find $\frac{\text{area of } \Delta PRT}{\text{area of } \Delta RQS}$.

$$\begin{aligned}\text{Ratio of area} &= \text{square of length} \\ &= \frac{8^2}{6^2} \dots \dots \dots [M1] \\ &= \frac{64}{36} \\ &= \frac{16}{9}\end{aligned}$$

Alternative solution $\Rightarrow$

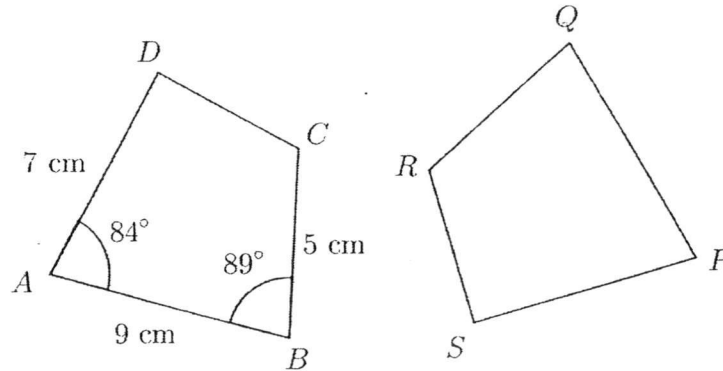
$$\begin{aligned}\text{Let height of } \Delta PRT \text{ be } h_1. \\ \text{Let height of } \Delta RQS \text{ be } h_2. \\ \frac{h_1}{h_2} &= \frac{8}{6} \\ \frac{\text{area of } \Delta PRT}{\text{area of } \Delta RQS} &= \frac{0.5 \times h_1 \times 8}{0.5 \times h_2 \times 6} [M1] \\ &= \frac{0.5 \times 8}{0.5 \times 6} \times \frac{h_1}{h_2} \\ &= \frac{4}{3} \times \frac{8}{6} \\ &= \frac{16}{9}\end{aligned}$$

Answer (d) $\frac{16}{9} \dots \dots [A1]$ [2]

For
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Use

- 9 The quadrilaterals $ABCD$ and $PQRS$ are congruent (not drawn to scale).



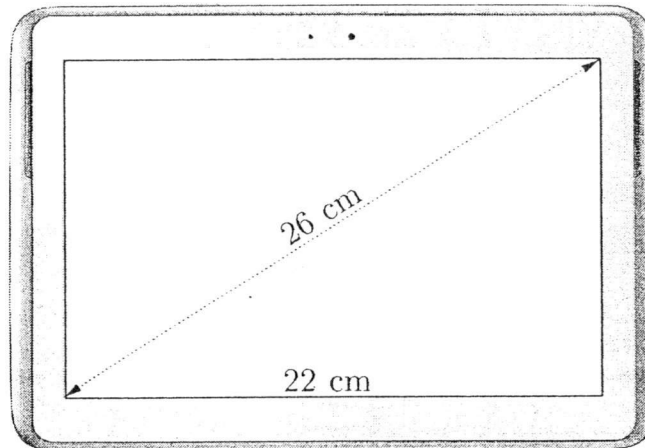
- (a) Write down the length of PQ .

Answer (a) $PQ = 9$ [B1] cm [1]

- (b) Write down $\angle PQR$.

Answer (b) $\angle PQR = 89$ [B1]° [1]

- 10 The figure below is an electronic tablet.
Some of the dimensions for its rectangular screen are shown below.



Find the height of the screen.

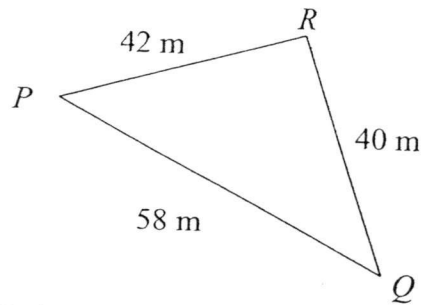
$$\begin{aligned}
 &\text{Let height be } h \text{ cm.} \\
 &\text{By Pythagoras' Theorem,} \\
 &22^2 + h^2 = 26^2 \\
 &h^2 = 26^2 - 22^2 \dots\dots [M1] \\
 &= 192 \\
 &h = \sqrt{192} \\
 &= 13.85640 \dots \\
 &= 13.8 \text{ (3sf)}
 \end{aligned}$$

Answer 13.8 [A1] cm [2]

For
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Use

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Use

- 11 The diagram shows a triangular piece of land PQR with the dimensions $PQ = 58$ m, $QR = 40$ m and $RP = 42$ m.



- (a) Prove that triangle PQR is a right-angled triangle.

$$QR^2 + PR^2 = 40^2 + 42^2$$

$$= 3364$$

$$PQ^2 = 58^2$$

$$= 3364$$

$$\therefore PQ^2 = QR^2 + PR^2 \dots \dots \dots [M1]$$

$\therefore$ By converse of Pythagoras Theorem, $\dots \dots \dots [A1]$
 ΔPQR is a right - angled triangle.

[2]

- (b) Find the area of the piece of land.

$$\text{Area} = \frac{1}{2} \times 42 \times 40 \dots \dots \dots [M1]$$

$$= 840$$

Answer (b) 840 [A1] m² [2]

- (c) Find the shortest distance from R to PQ .

Let shortest distance be d .

$$\frac{1}{2} \times d \times 58 = 840 \dots \dots \dots [M1]$$

$$d = 840 \times 2 \div 58$$

$$= 28 \frac{28}{29}$$

$$= 28.9655 \dots$$

$$= 29.0 \text{ (3sf)}$$

Answer (c) 29.0 or $28 \frac{28}{29}$ [A1] m [2]

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Section B (40 marks)

12 Expand and simplify the following

(a) $2(x^2 - 3x + 2) - 3(x^2 + x - 2)$, [1]

$$2(x^2 - 3x + 2) - 3(x^2 + x - 2) = 2x^2 - 6x + 4 - 3x^2 - 3x + 6$$

$$= -x^2 - 9x + 10 \dots \dots \dots [B1]$$

(b) $(2x - 3)(x^2 - 2x - 4)$ [2]

$$(2x - 3)(x^2 - 2x - 4) = 2x(x^2 - 2x - 4) - 3(x^2 - 2x - 4) \dots [M1]$$

$$= 2x^3 - 4x^2 - 8x - 3x^2 + 6x + 12$$

$$= 2x^3 - 7x^2 - 2x + 12 \dots \dots \dots [A1]$$

(c) $3x^2 + 1 - 2(x + 1)^2$. [3]

$$3x^2 + 1 - 2(x + 1)^2 = 3x^2 + 1 - 2(x^2 + 2x + 1) \dots [M1]$$

$$= 3x^2 + 1 - 2x^2 - 4x - 2 \dots \dots [M1]$$

$$= x^2 - 4x - 1 \dots \dots \dots [A1]$$

13 (a) (i) Expand $(a - b)^2$. [1]

$$(a - b)^2 = a^2 - 2ab + b^2 \dots \dots [M1]$$

(ii) Hence, using your result in (a)(i), evaluate 98^2 . [2]

Let $a = 100$, $b = 2$.

$$98^2 = (100 - 2)^2$$

$$= 100^2 - 2(100)(2) + 2^2 \dots \dots [M1]$$

$$= 10000 - 400 + 4$$

$$= 9604 \dots \dots \dots [A1]$$

(b) If $(x - y)^2 = 57$ and $xy = 4$, find the value of $(x + y)^2$. [2]

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$x^2 - 2xy + y^2 = 57$$

$$x^2 - 2(4) + y^2 = 57$$

$$x^2 - 8 + y^2 = 57$$

$$x^2 + y^2 = 65 \dots \dots \dots [M1]$$

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$x^2 + 2xy + y^2 = 65 + 2(4)$$

$$= 73 \dots \dots \dots [A1]$$

14 Factorise the following completely

(a) $2n^2 - 18$ [2]

$$2n^2 - 18 = 2(n^2 - 9) \dots \dots \dots [M1]$$

$$= 2(n + 3)(n - 3) \dots \dots \dots [A1]$$

(b) $pq - 2q + 2 - p$. [2]

$$pq - 2q + 2 - p = q(p - 2) - (p - 2) \dots \dots [M1]$$

$$= (q - 1)(p - 2) \dots \dots \dots [A1]$$

15 Express the following as a single fraction in its simplest form

(a) $\frac{4}{3x} + \frac{1}{2+x}$ [2]

$$\begin{aligned}\frac{4}{3x} + \frac{1}{2+x} &= \frac{4(2+x)}{3x(2+x)} + \frac{3x}{3x(2+x)} \dots [M1] \\ &= \frac{8+4x+3x}{3x(2+x)} \\ &= \frac{8+7x}{3x(2+x)} \dots \dots \dots [A1]\end{aligned}$$

(b) $\frac{3xy^3}{8z^2} \div \frac{9y^2}{10xz}$ [2]

$$\begin{aligned}\frac{3xy^3}{8z^2} \div \frac{9y^2}{10xz} &= \frac{3xy^3}{8z^2} \times \frac{10xz}{9y^2} \dots \dots [M1 \text{ for cancelling}] \\ &= \frac{5x^2y}{12z} \dots \dots \dots [A1]\end{aligned}$$

(c) $\frac{3}{2x-1} - \frac{6x-1}{(2x-1)^2}$ [3]

$$\begin{aligned}\frac{3}{2x-1} - \frac{6x-1}{(2x-1)^2} &= \frac{3(2x-1)}{(2x-1)^2} - \frac{6x-1}{(2x-1)^2} \dots [M1] \\ &= \frac{3(2x-1) - (6x-1)}{(2x-1)^2} \dots \dots [M1] \\ &= \frac{6x-3-6x+1}{(2x-1)^2} \\ &= \frac{2}{(2x-1)^2} \dots \dots \dots [A1]\end{aligned}$$

16 (a) Express $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x}$ as a single fraction. [2]

$$\begin{aligned}\frac{1}{x-2} \times \frac{6-x-x^2}{1-x} &= \frac{1}{x-2} \times \frac{(3+x)(2-x)}{1-x} \dots \dots \dots [M1] \\ &= \frac{1}{x-2} \times -\frac{(3+x)(x-2)}{1-x} \\ &= -\frac{3+x}{1-x} \text{ or } \frac{-3-x}{1-x} \text{ or } \frac{3+x}{x-1} \dots [A1]\end{aligned}$$

(b) Hence, or otherwise, solve the equation $\frac{1}{x-2} \times \frac{6-x-x^2}{1-x} = 5$. [2]

$$\begin{aligned}\frac{1}{x-2} \times \frac{6-x-x^2}{1-x} &= 5 \\ \frac{3+x}{x-1} &= 5 \dots \dots \dots [M1] \\ 3+x &= 5x-5 \\ 8 &= 4x \\ x &= 2 \dots \dots \dots [A1]\end{aligned}$$

NOTE: Strictly speaking, $x = 2$ cannot be a solution, because $\frac{1}{x-2}$. Only found this out after banking in the paper.

17

It is given that $Q = \sqrt{\frac{3P-1}{2P+1}}$.

80

- (a) If
- $P = 2$
- , find the value of
- Q
- .

[2]

$$\begin{aligned}
 Q &= \sqrt{\frac{3(2) - 1}{2(2) + 1}} \dots \dots [M1] \\
 &= \sqrt{\frac{5}{5}} \\
 &= \sqrt{1} \\
 &= 1 \dots \dots \dots [A1]
 \end{aligned}$$

- (b) Make
- Q
- the subject of the formula.

[3]

$$\begin{aligned}
 Q &= \sqrt{\frac{3P - 1}{2P + 1}} \\
 Q^2 &= \frac{3P - 1}{2P + 1} \dots \dots [M1] \\
 Q^2(2P + 1) &= 3P - 1 \\
 2PQ^2 + Q^2 &= 3P - 1 \\
 2PQ^2 - 3P &= -1 - Q^2 \dots \dots [M1] \\
 P(2Q^2 - 3) &= -1 - Q^2 \\
 P &= \frac{-1 - Q^2}{2Q^2 - 3} \text{ or } \frac{1 + Q^2}{3 - 2Q^2} \dots \dots [A1]
 \end{aligned}$$

- (c) Hence, or otherwise, find the value of
- P
- when
- $Q = 2$
- .

[2]

"Hence" Solution:

$$\begin{aligned}
 P &= \frac{1 + (2)^2}{3 - 2(2)^2} \dots \dots [M1] \\
 &= \frac{5}{-5} \\
 &= -1 \dots \dots \dots [A1]
 \end{aligned}$$

"Otherwise" Solution:

$$\begin{aligned}
 2 &= \sqrt{\frac{3P - 1}{2P + 1}} \\
 4 &= \frac{3P - 1}{2P + 1} \dots \dots [M1] \\
 8P + 4 &= 3P - 1 \\
 5P &= -5 \\
 P &= -1 \dots \dots \dots [A1]
 \end{aligned}$$

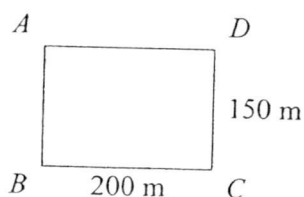
- 18 The time taken, t minutes, to pack all the Examination Care Packs is inversely proportional to the number of students, N , involved in the packing.

If a team of 3 students take 50 minutes to pack all the Examination Care Packs, how many **more** students are needed if the packing must be completed 20 minutes earlier?

[3]

$$\begin{aligned}
 t &\propto \frac{1}{N} \\
 t &= \frac{k}{N} \text{ or } tN = k \\
 k &= (50)(3) \\
 k &= 150 \\
 \therefore tN &= 150 \dots \dots [M1]
 \end{aligned}
 \qquad
 \begin{aligned}
 \text{Let } t &= 30 \\
 30N &= 150 \\
 N &= 5 \dots \dots [M1] \\
 5 - 3 &= 2 \\
 \therefore 2 \text{ more students.} \dots \dots [A1]
 \end{aligned}$$

- 19 The diagram below shows a rectangular field $ABCD$ (not drawn to scale) with dimensions 200 m by 150 m.



- (a) Find the distance from point A to point C .

[2]

$$\begin{aligned}
 &\text{By Pythagoras Theorem,} \\
 AC^2 &= 200^2 + 150^2 \\
 AC &= \sqrt{200^2 + 150^2} \dots \dots [M1] \\
 &= 250 \dots \dots [A1] \\
 \therefore \text{distance from } A \text{ to } C &= 250 \text{ m}
 \end{aligned}$$

- (b) Mr. Cheow bought a new remote-controlled helicopter drone, and wants to fly it by standing at point A . The remote control has a maximum range of 225 m. Can the maximum range cover the whole field from where he stands? Explain why.

[2]

No. [B1]

The helicopter cannot reach point C if Mr. Cheow stands at point A .
(or any acceptable answer provided by student) [B1]