SYDNEY BOYS HIGH
MOORE PARK, SURRY HILLS

2015
YEAR 9 HALF-YEARLY EXAMINATION

Mathematics

Directions to Candidates:

- Answer all questions in the spaces provided in this question booklet.
- If additional working space is needed, use the spare pages at the end of the booklet. Show clearly which question you are continuing.
- All *necessary* working MUST be shown in every question if full marks are to be awarded.
- Full marks may not be awarded for careless or badly arranged work.
- Write using black or blue pen.
- Board-approved calculators may be used.
- All answers should be in simplest exact form unless specified otherwise.

Time allowed: 90 minutes
Examiner: R. Boros

Name: _____

Your Mathematics Class (Tick the box)		
9Ma**A**	Ms Kilmore	
9Ma**B**	Ms Chen/Mr Elliott	
9Ma**C**	Ms Millar/Evans	
9Ma**D**	Ms Likourezos	
9Ma**E**	Mr Fuller	
9Ma**F**	Ms Ward/Mr Taylor	
9Ma**G**	Mr Parker	

Markers' Use Only	
Question 1	/12
Question 2	/21
Question 3	/14
Question 4	/20
Question 5	/15
Question 6	/15
Question 7	/23
Total	/120

Question 1 (12 marks) **Answers** **Marks**

(a) Which is greater and by how much, $\frac{2}{5}$ or $\frac{3}{8}$? 1

(b) Arrange in descending order of size: $\frac{7}{10}, \frac{3}{4}, \frac{11}{15}, \frac{2}{3}$. 1

(c) Find $\frac{3}{5}$ of \$26. 1

(d) Express $\sqrt{7\frac{1}{9}}$ as a ratio of two whole numbers. 1

(e) Write $\frac{5}{9}$ as a decimal. 1

(f) Simplify 0.005×0.04, putting your answer as a decimal. 1

(g) A coat was given a 15% discount in price. It now costs \$70. What was the price before the discount? 1

(h) State the number of significant figures in:

(i) 672 006, ... 1

(ii) 0.051 96. 1

(i) Express 5.376 891 correct to three decimal places. 1

(j) Round 4 687 859 to four significant figures. 1

(k) If $y = 5x^2 - 7x - 6$, find the value of y when $x = -3$. 1

Marks

Question 2 (21 marks) **Answers**

(a) Simplify the following:

(i) $7a - 9a$, ... 1

(ii) $6pq + 5qp - 12pq$, ... 1

(iii) $5x^2 - 8x - 6 - 3x^2 + 7x$, ... 1

(iv) $x^6 \div 2x^5$, ... 1

(v) $4a \times 2a \times {}^{-}a$, ... 1

(vi) $\sqrt{144a^4b^8}$, ... 1

(vii) $\left(-2x^3\right)^4$, ... 1

(viii) $12x^3y^2 \div {}^{-}4xy$. 1

(b) Factorise each of the following:

(i) $2x - 6$, ... 1

(ii) $5x^2 - 10x$, ... 1

(iii) $-3x - 9x^2$. 1

(c) Expand out and simplify where possible:

(i) $7(2p - q)$, ... 1

(ii) $3(x + 2) - 2(x + 2)$, ... 1

(iii) $3(5a - 8b) - 3(2a - b)$, ... 1
.....

(iv) $5x(3x - 8) + 4x$, ... 1
.....

(v) $(x + 7)(2x - 3)$, ... 1
.....

(vi) $(2x + 4)^2$. 1
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(d) Sketch the following and clearly label each diagram.

(i) Straight angle ABC: 1

(ii) Reflex angle XYZ: 1

(iii) A pair of adjacent angles: 1

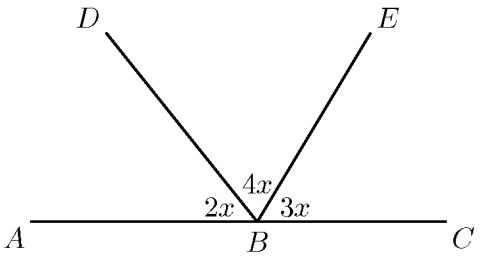
(iv) An acute-angled scalene triangle PQR: 1

Marks

Question 3 (14 marks) **Answers**

(a) Find the value of each pronumeral in the following (reasons are not needed).

(i)



ABC is a straight line. 1

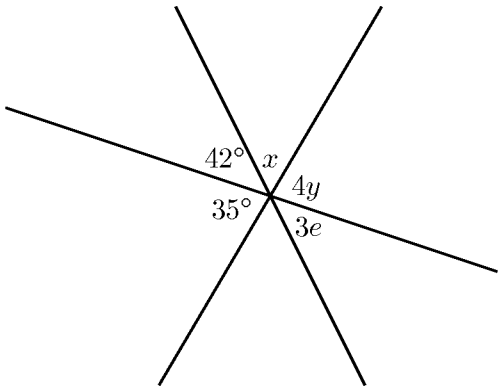
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$x =$ .....

(ii)



All lines are straight. 3

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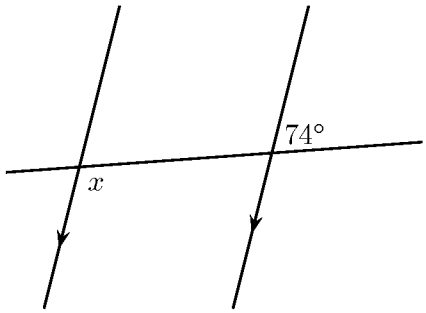
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$x =$ .....

$e =$ .....

$y =$ .....

(iii)



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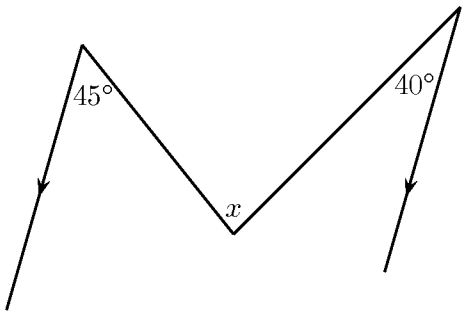
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$x =$ .....

(iv)



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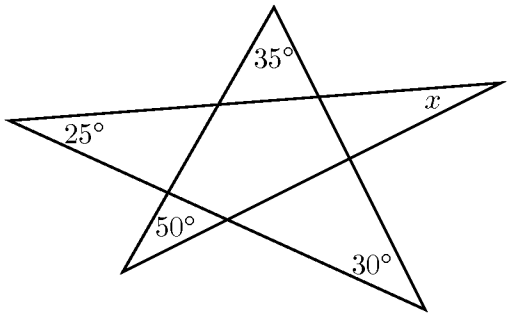
$x =$ .....

(b) Imagine the drawing of a regular pentagon. Find the size of each interior and exterior angle in this figure.

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(c)



All lines are straight. Find x.

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(d) A convex polygon is a polygon in which each interior angle is less than 180°. Which of the following number(s) could **not** be the number of diagonals in a convex polygon?

$$\{9, 27, 45, 54, 67\}$$

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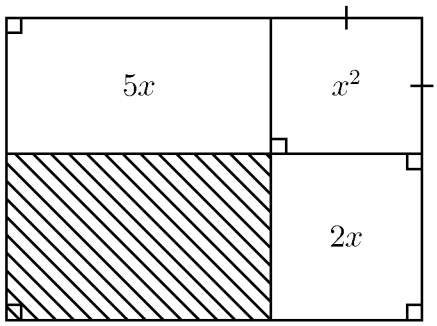
Question 4 (20 marks) **Answers** **Marks**

(a) The sides of a triangle have lengths $7\frac{1}{2}$ cm, 11 cm, and x cm, where x is a whole number. What is the smallest possible value of x? [2]

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(b) 

In the diagram shown, determine the size of the shaded area. [2]

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(c) The length of one pair of opposite sides of a square is reduced by 10% and the length of the other pair of sides is increased by 10%. What is the ratio of the area of the new rectangle compared with the original square? [3]

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(d) A town has 2500 residents who are old enough to vote. 60% of them voted in an election to fill a local council vacancy. Of those who voted, 38% voted for **P**, 32% for **Q**, and 30% for **R**. Under the voting system, **P** was elected. How many residents voted for **P**? [2]

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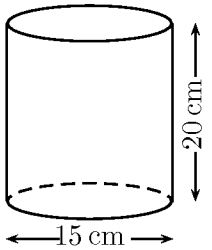
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(e) A circle has an area of $625\,\text{cm}^2$.
Find correct to one decimal place:

(i) the radius of the circle, ... 1

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(ii) the circumference of the circle. 1

(f) 

Find the volume of this cylinder correct to two decimal places. 2

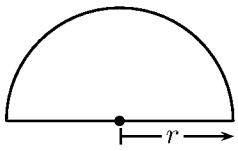
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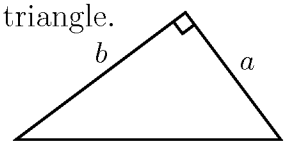
(g) Find a formula for the perimeter P of:

(i) a semi-circle, 

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(ii) a right-angled triangle. 

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(h) A baseball team has won 50% of the 60 games played. Find the number of games the team must win in succession to increase its winning percentage to 60%. 3

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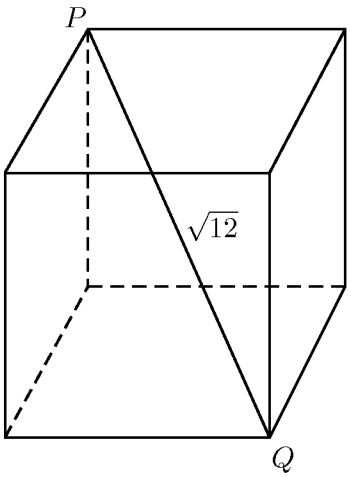
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Marks

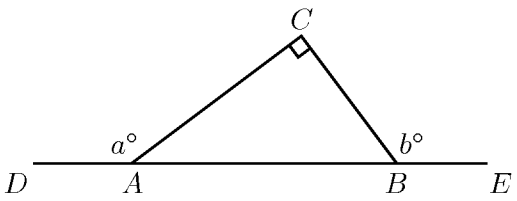
Question 5 (15 marks) **Answers**

(a) 

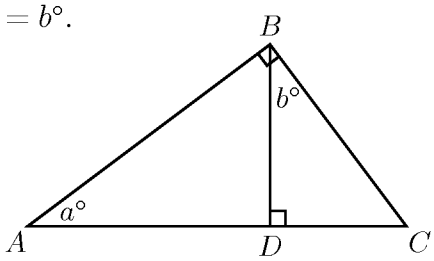
The cube above has a diagonal length $PQ = \sqrt{12}$ cm. Find the volume of the cube in cm^3. 3

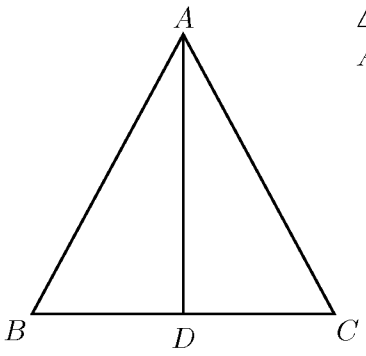
(b) Prove the following results by showing full reasoning with your answers.

(i) $a° + b° = 270°$. 2



(ii) $a° = b°$. 2



(c) 

$\triangle ABC$ is isosceles with $AB = AC$.
AD is the bisector of $\angle BAC$.

(i) Prove that $\triangle ABD$ is congruent to $\triangle ACD$ (full proof). [2]

(ii) What can be deduced about

(α) BD and CD? [1]

(β) AD and BC? [1]

(d) On a map which has a scale of 1 : 25 000 find:

(i) the real distance when the map distance is 4 cm, [1]

(ii) the map distance corresponding to an actual distance of 625 km. [1]

(e) Draw a detailed diagram to show this information:
$\triangle ABC$ is isosceles, CA is produced (extended) to D, and DE is drawn perpendicular to BC. Also DE and AB meet at X. [2]

Question 6 (15 marks) **Answers** **Marks**

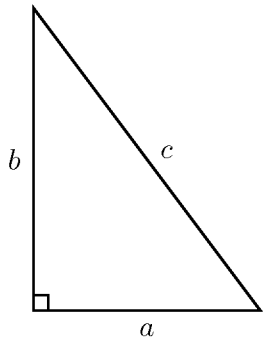
(a) Which of the numbers from this set can be written in rational form? 2

$$\left\{-3\frac{1}{2},\ \sqrt{7},\ 0,\ \pi,\ \frac{22}{7},\ 0.\dot{7},\ \sqrt{9}\right\}$$

(b) Mixed up Ron could never quote anything correctly and his version of the Pythagorean Theorem was 3

> The semi-circle on the hypotenuse is equal to the sum of the semi-circles on the other two sides.

His class assumed he was referring to areas. Using the diagram below as a starting point, prove that Ron was still correct.



(c) Simplify $\frac{5}{6x} - \frac{1}{2x}$. 1

(d) How many cubes of edge 5 cm are contained in a cube of edge 0.2 m? 2

(e) How many sides has a regular polygon with an interior angle of 162°?

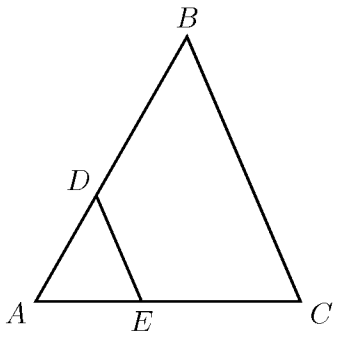
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(f) Construct a line $\sqrt{5}$ cm in length.

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(g)



ABC is any triangle. D is a point on AB and E is a point on AC such that $\angle DEC = \angle BAC + \angle ABC$.
Prove that $DE \parallel BC$.

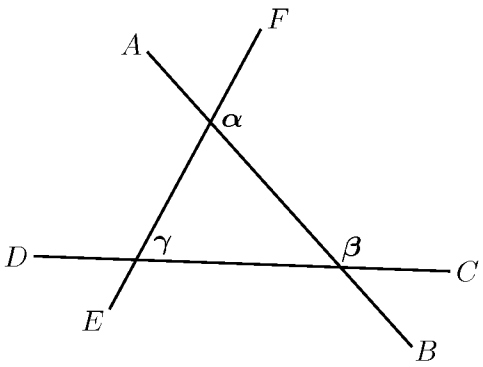
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Question 7 (23 marks) **Answers** **Marks**

(a) The quadratic equation $ax^2 + bx + c = 0$ has two solutions.
One solution uses $\dfrac{-b + \sqrt{b^2 - 4ac}}{2a}$ and the other solution uses $\dfrac{-b - \sqrt{b^2 - 4ac}}{2a}$.
Use this method to find the two solutions of $3x^2 - 7x + 2 = 0$. [3]

(b) In the diagram (not to scale) AB, CD, and EF are straight lines. Find the value of $\boldsymbol{\alpha} + \boldsymbol{\beta} - \boldsymbol{\gamma}$. [2]

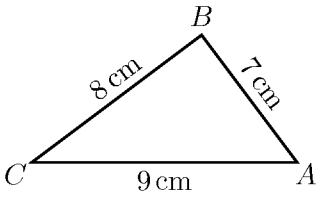


(c) 40 bicycles were bought wholesale by a bikeshop at \$750 each. Some were sold at a profit of 40% and the remainder at half of the first selling price. The whole profit on the sale of the 40 bicycles was \$7800. How many bicycles were sold at the reduced sale price? [4]

(d) Herron's formula gives the area of a triangle in terms of its side lengths a, b, and c:

$$A = \sqrt{S(S-a)(S-b)(S-c)}$$

where $2S = a + b + c$.
Using this formula, find the area of this triangle correct to three significant figures.



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(e) Simplify $\dfrac{3x - 3y}{y - x}$.

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(f) Bacteria in a petri dish can double in size every day. If it takes 64 days to completely cover the face of the petri dish, how many days did it take to cover $\dfrac{1}{8}$ of the dish?

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(g) Here are the first two rows of what is called "a difference table". 2

Row 1 :	2	3	10	19	58	117
Row 2 :	1	7	9	39	59	

What are the numbers in the fourth row?

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(h) A number is called "LUCKY" if it is a positive integer which contains at least one 7 amongst its digits.
Examples lucky numbers: 7, 37, 77 071,
unlucky numbers: 3, 99, 12 345.
Let S_n denote the set of all integers from 1 to 10^n.
So $S_1 = \{1, 2, 3, \ldots 10\}$
$S_2 = \{1, 2, 3, \ldots 100\}$

(i) How many lucky numbers are there in S_1? 1

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(ii) How many unlucky numbers are there in S_2? 1

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(iii) How many lucky numbers would you expect in S_7? 2

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(iv) Brenda says that most numbers are lucky. She reasons that if you choose an integer at random, then the chances are that it will be lucky.
Is Brenda correct?
Explain your reasoning. 1

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End of Paper

Extra working page

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