



Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

MATHEMATICS

COMMON TEST

JUNE 2017

**NATIONAL
SENIOR CERTIFICATE**

GRADE 10

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and 2 DIAGRAM SHEETS.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 8 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera, which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. TWO diagram sheets for answering QUESTION 7.1, QUESTION 7.2, QUESTION 7.3, QUESTION 8.1 and QUESTION 8.2 are attached at the end of this question paper. Write your name on these sheets in the spaces provided and insert the sheets inside the back cover of your ANSWER BOOK.
8. Diagrams are NOT necessarily drawn to scale.
9. Number the answers correctly according to the numbering system used in this question paper.
10. Write neatly and legibly.

QUESTION 1

1.1 Factorise the following expressions fully:

1.1.1 $7x + 14$ (1)

1.1.2 $2x^2 + 2ax - 3bx - 3ab$ (3)

1.2 Determine the product of the following expression:

$-2(x+1)(x^2 - x + 1)$ (3)

1.3 Calculate the value of the following expression **without using a calculator**:

$(0,072)^2 - (0,028)^2$ (2)

1.4 Simplify the following expression fully:

$$\frac{5x^2 + 14x - 3}{x^2 - 9}$$
 (3)

1.5 Evaluate the following expression:

$$\frac{2^{x+1} \cdot 9^{x-2}}{6^{x-1} \cdot 3^{x+1}}$$
 Write your answer as a fraction in its simplest form. (5)
[17]

QUESTION 2

2.1 Solve for x : $4^x = 1$ (2)

2.2 Given: $\frac{x}{4} + 15 \leq \frac{5x}{3} - 2$ where $x \in R$

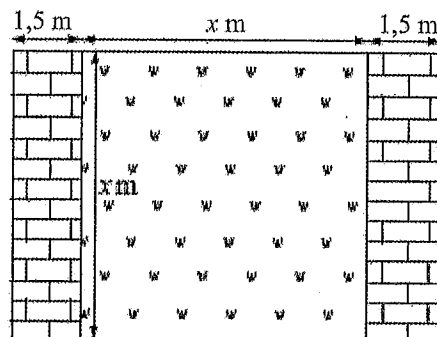
2.2.1 Solve for x . (3)

2.2.2 Write the answer to QUESTION 2.2.1 in interval notation. (1)

2.3 Solve simultaneously for x and y :

$x - 2y = 3$ and $4x + 3y + 10 = 0$ (5)

- 2.4 A rectangular garden is made up of a square lawn of side x m and two paths 1,5 m wide, as shown in the diagram below. The total area of the garden is 88 m^2 . Write down an equation in terms of x and solve the equation to find the dimensions of the lawn.



NOT
TO
SCALE

(5)
[16]

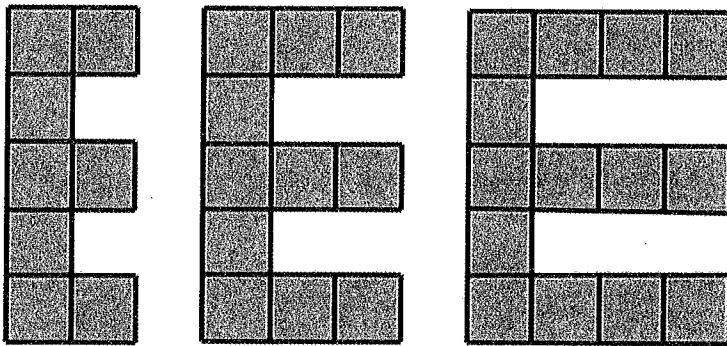
QUESTION 3

3.1 The n th term of a pattern is given as $T_n = 12n - 7$.

3.1.1 Write down the first three terms of this pattern. (2)

3.1.2 Is 356 a term in this pattern? Explain your answer. (2)

3.2 Consider the following sequence of Es:



3.2.1 How many blocks are needed to make the next E? (1)

3.2.2 Write down the general term, T_n , for the number of blocks used in each E. (2)

3.2.3 Calculate how many blocks will be needed to make the 100th E. (2)

3.2.4 Calculate which E can be made from 116 blocks. (3)
[12]

QUESTION 4

The following functions are given: $f(x) = x - 2$ and $g(x) = \frac{4}{x} - 2$

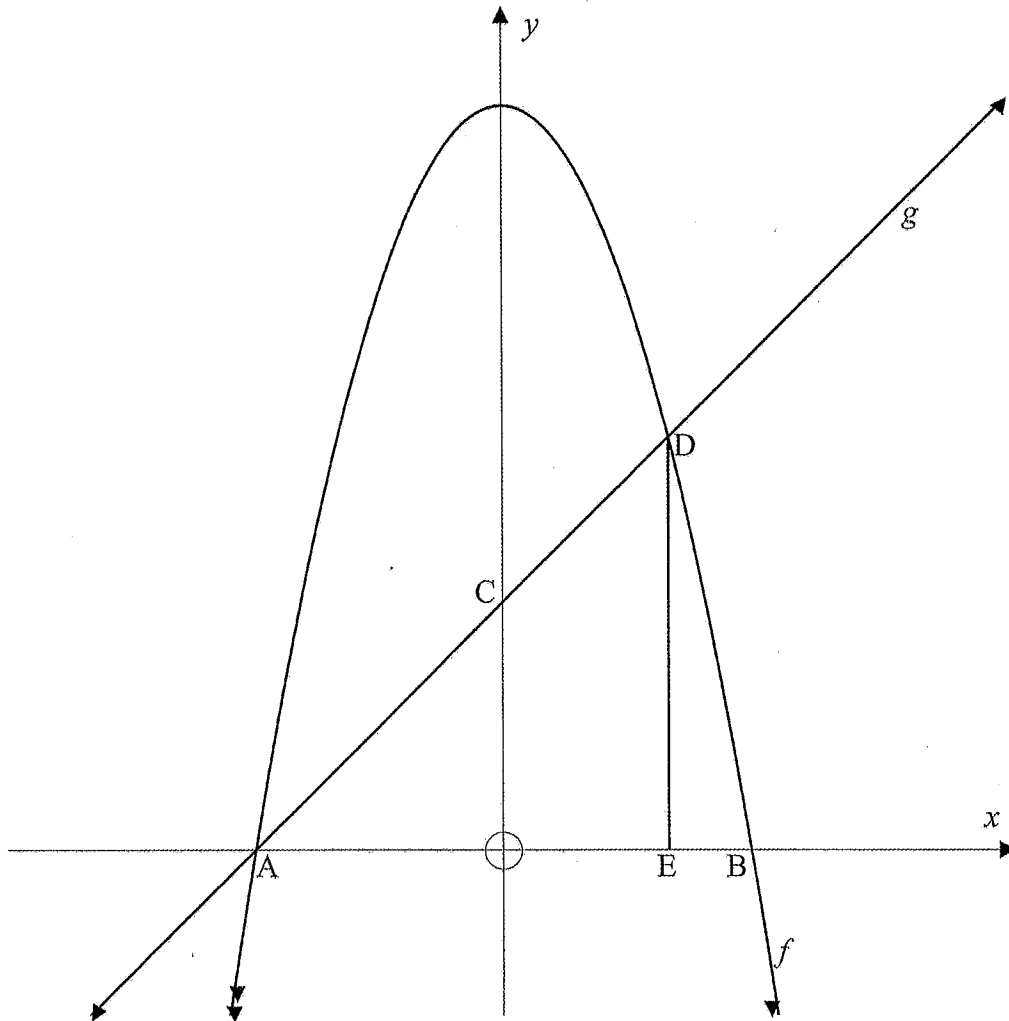
Sketch the graphs of f and g on the same set of axes, clearly showing all intercepts with the axes and asymptotes where applicable.

[6]

QUESTION 5

Sketched below are the graphs of $f(x) = -4x^2 + 9$ and $g(x) = 2x + 3$.

The graph of f intersects the x -axis at A and B. The graph of g intersects f at A and D and the y -axis at C. $DE \parallel y$ -axis.



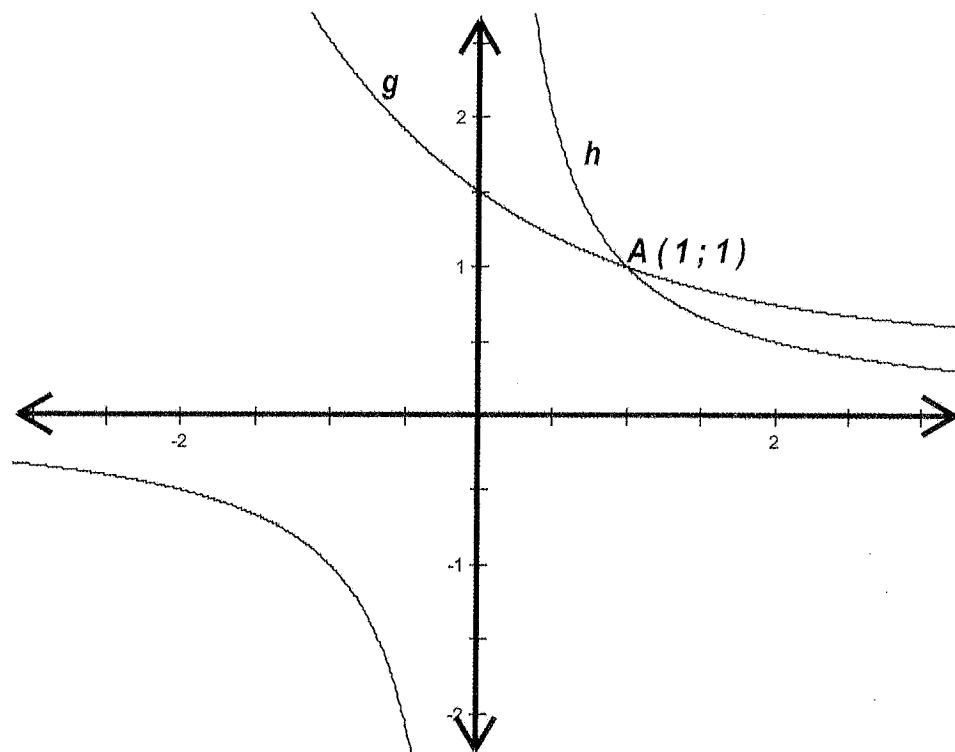
- 5.1 Write down the coordinates of C. (1)
- 5.2 Calculate the length of AB. (3)
- 5.3 Calculate the length of DE if $AE = 2\frac{1}{2}$ units. (2)
- 5.4 For which values of x will $f(x) > g(x)$? (2)
- 5.5 Calculate the length of AD. (2)

[10]

QUESTION 6

Sketched below are the graphs of g and h . $g(x) = b^x + c$ and $h(x) = \frac{k}{x}$.

A, the point of intersection of g and h , is $(1; 1)$.



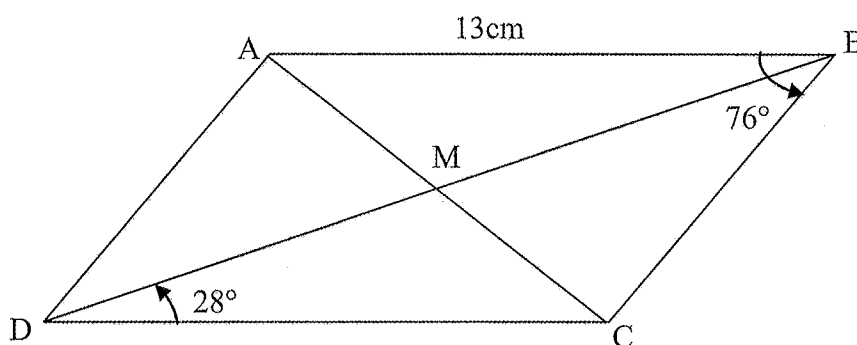
Use the graphs and the information above to answer the following :

- 6.1 Write down the values of k , c and b . (4)
 - 6.2 Write down the equation of the asymptote of g . (1)
 - 6.3 Write down the domain of h . (2)
 - 6.4 Determine the equation of f if f is the reflection of g in the y -axis. (2)
- [9]**

QUESTION 7

In this question, you must give a reason to justify each of your statements.

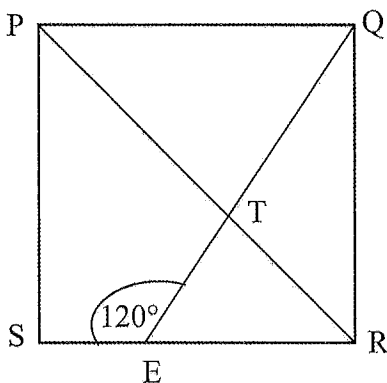
- 7.1 In the diagram below, the diagonals of parallelogram ABCD intersect in M. $AB = 13\text{cm}$, $\hat{ABC} = 76^\circ$ and $\hat{CDM} = 28^\circ$.



- 7.1.1 Write down, giving a reason, the length of DC. (2)

- 7.1.2 Calculate, giving reasons, the size of $\hat{ADM}$. (2)

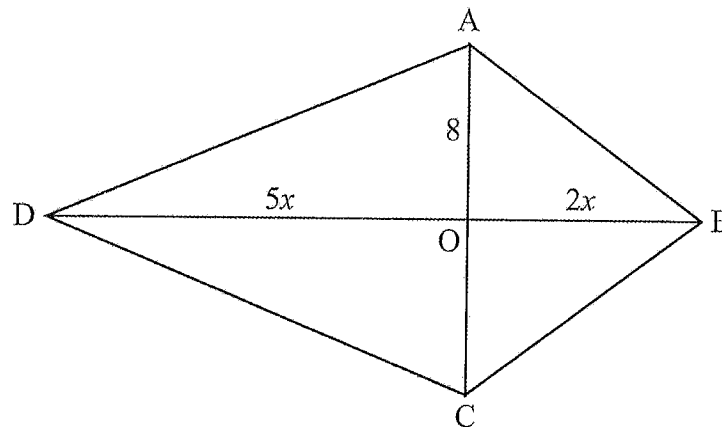
- 7.2 In the diagram below, PR is a diagonal of square PQRS. Point E lies on SR and QE is drawn. PR and QE intersect at T. $\hat{SET} = 120^\circ$.



- 7.2.1 Give a reason why $\hat{SPR} = 45^\circ$. (1)

- 7.2.2 Calculate, giving reasons, the size of $\hat{PTE}$. (2)

- 7.3 In the diagram below, ABCD is a kite having diagonals AC and BD intersecting at O. $AO = 8\text{cm}$, $BO = 2x\text{ cm}$ and $DO = 5x$



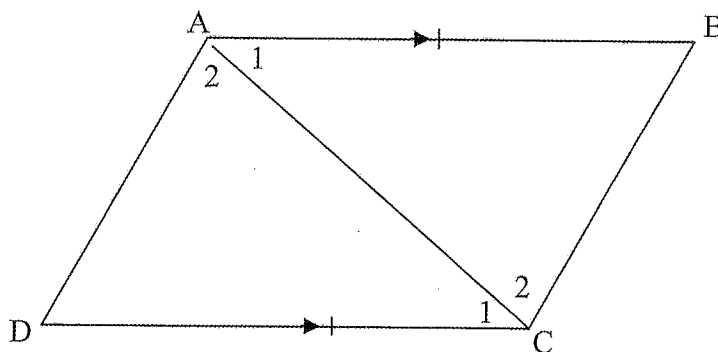
cm.

- 7.3.1 Write down, giving a reason, the length of OC. (2)
- 7.3.2 Write down the area of ABCD in terms of x . (2)
- 7.3.3 If the area of ABCD is 168cm^2 , calculate the value of x . (2)
- 7.3.4 Calculate, giving a reason, the length of AB. (3)
- [16]**

QUESTION 8

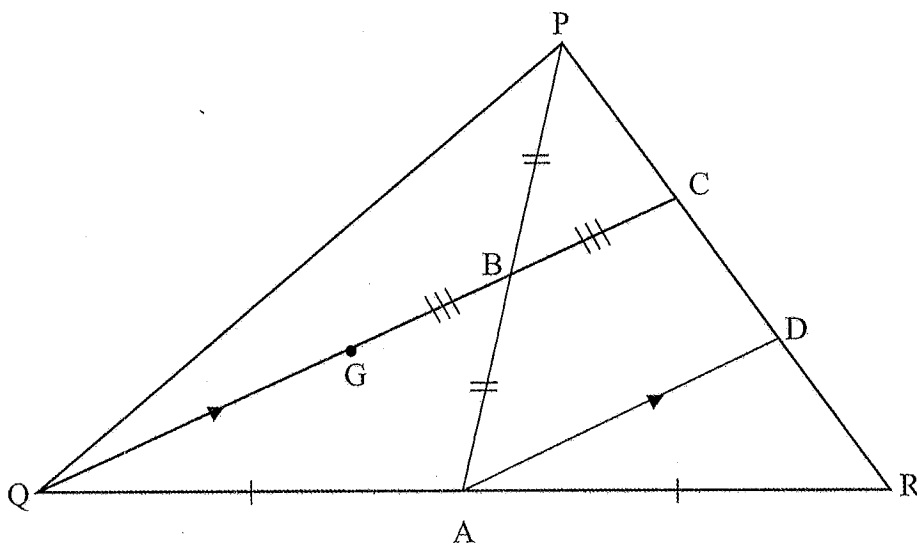
In this question, you must give a reason to justify each of your statements.

- 8.1 In the diagram below, ABCD is a quadrilateral having $AB = DC$ and $AB \parallel DC$.



Use the diagram on the DIAGRAM SHEET to prove that ABCD is a parallelogram. (5)

- 8.2 In $\triangle PQR$, A is the midpoint of QR and B is the midpoint of PA. C and D are points on PR such that $QBC \parallel AD$. G is a point on QB such that $GB = BC$.



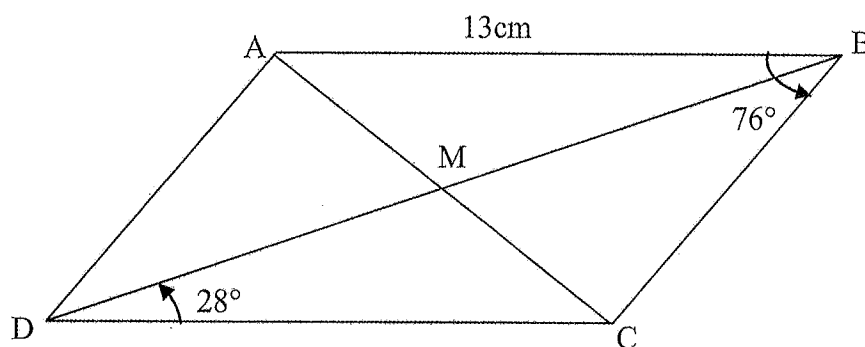
- 8.2.1 Give a reason why PGAC is a parallelogram. (1)
- 8.2.2 Prove that $PC = CD = DR$. (4)
- 8.2.3 Prove that GCDA is a parallelogram (4)
- [14]

TOTAL MARKS: 100

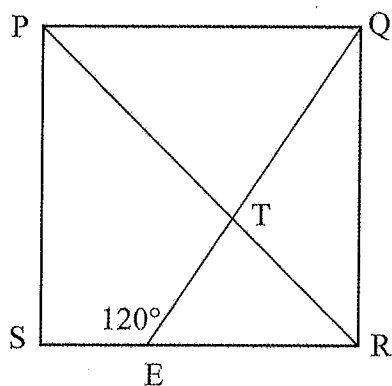
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DIAGRAM SHEET 1

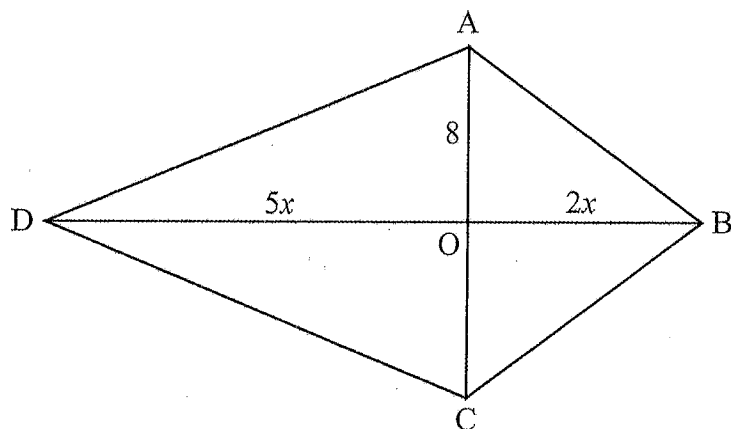
QUESTION 7.1



QUESTION 7.2



QUESTION 7.3

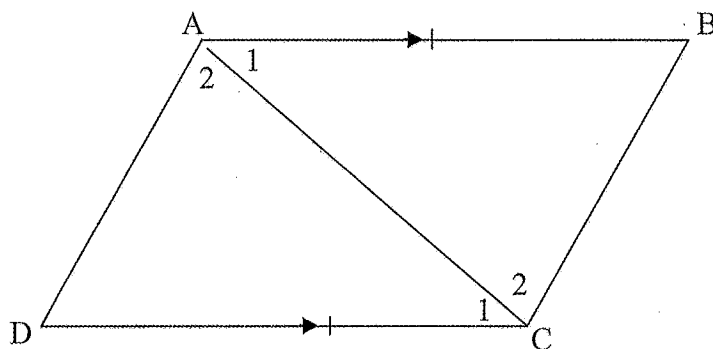


PLEASE TEAR ON DOTTED LINES

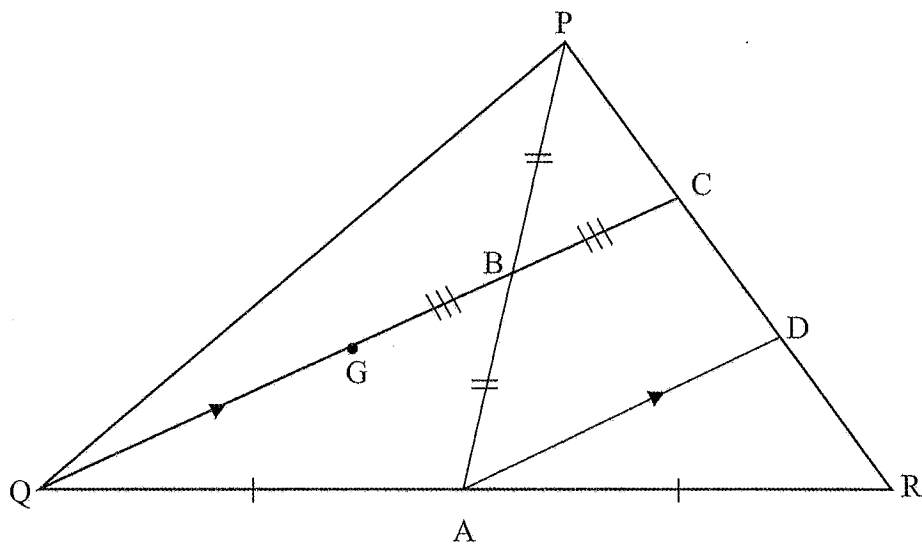
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DIAGRAM SHEET 2

QUESTION 8.1



QUESTION 8.2



PLEASE TEAR ON DOTTED LINES



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SYMBOL	DESCRIPTION
✓S	Mark for correct statement, no penalty for reason omitted
✓R	Mark for reason
✓S/R	Mark for correct statement with correct reason

This marking guideline consists of 9 pages.

QUESTION 1

1.1.1	$7x+14$ $= 7(x+2)$	✓ answer	(1)
1.1.2	$2x^2 + 2ax - 3bx - 3ab$ $= 2x(x+a) - 3b(x+a)$ $= (x+a)(2x-3b)$ OR $2x^2 - 3bx + 2ax - 3ab$ $= x(2x-3b) + a(2x-3b)$ $= (x+a)(2x-3b)$	✓ $2x(x+a)$ ✓ $-3b(x+a)$ ✓ answer	(3)
1.2	$-2(x+1)(x^2-x+1)$ $= -2(x^3+1)$ $= -2x^3-2$	✓ $x(2x-3b)$ ✓ $+a(2x-3b)$ ✓ answer	(3)
1.3	$(0,072)^2 - (0,028)^2$ $= (0,072+0,028)(0,072-0,028)$ $= (0,1)(0,044)$ $= 0,0044$	✓ x^3+1 ✓ answer	(3)
1.4	$5x^2+14x-3$ $\frac{x^2-9}{(5x-1)(x+3)}$ $= \frac{(x-3)(x+3)}{(x-3)(x+3)}$ $= \frac{5x-1}{x-3}$	✓ $(0,72+0,28)(0,72-0,28)$ ✓ answer	(2)
1.5	$2^{x+1} \cdot 9^{x-2}$ $6^{x-1} \cdot 3^{x+1}$ $= \frac{2^{x+1} \cdot (3^2)^{x-2}}{(2 \times 3)^{x-1} \cdot 3^{x+1}}$ $= \frac{2^{x+1} \cdot 3^{2x-4}}{2^{x+1} \cdot 3^{2x-4}}$ $= 2^2 \cdot 3^{-4}$ $= \frac{4}{81}$	✓ $(5x-1)(x+3)$ ✓ $(x-3)(x+3)$ ✓ answer	(3)
		✓ prime bases ✓ 3^{2x-4} ✓ $2^{x+1} \cdot 3^{x+1}$ ✓ simplification ✓ answer	(5)
			17

QUESTION 2

2.1	$4^x = 1$ $4^x = 4^0$ $x = 0$	$\checkmark 1 = 4^0$ $\checkmark$ answer	(2)
2.2.1	$\frac{x+15}{4} \leq \frac{5x-2}{3}$ $3x+180 \leq 20x-24$ $-17x \leq -204$ $x \geq 12$ OR $\frac{x+15}{4} \leq \frac{5x-2}{3}$ $\frac{3x}{12} + 15 \leq \frac{20x-2}{12}$ $\frac{17x}{12} \leq -17$ $x \geq 12$	$\checkmark$ multiplying by 12 $\checkmark$ simplification $\checkmark$ answer (3)	(3)
2.2.2	$x \in [12; \infty)$	$\checkmark$ common denominator for x $\checkmark$ simplification $\checkmark$ answer	(3)
2.3	$x-2y=3$ $x=2y+3$ $4(2y+3)+3y+10=0$ $8y+12+3y+10=0$ $11y=-22$ $y=-2$ $x=2(-2)+3$ $x=-1$	$\checkmark x=2y+3$ $\checkmark$ substitution $\checkmark$ multiplying out $\checkmark y$ -value $\checkmark x$ -value	(5)
2.4	Area of rectangle = $l \times b$ $88 = x(x+3)$ $x^2+3x-88=0$ $(x-8)(x+11)=0$ $x=8 \because x \neq -11$ $\therefore$ The lawn is 8 m by 8 m	$\checkmark x(x+3)$ $\checkmark$ equating to 88 $\checkmark$ standard form $\checkmark$ factors $\checkmark$ answer	(5)

[16]

QUESTION 3

3.1.1	The sequence is: 5; 17; 29; ...	$\checkmark 5$ $\checkmark 17$ and 29	(2)
3.1.2	No $12n-7=356$ 363 is not exactly divisible by 12 OR 12 is not a multiple of 363	$\checkmark$ answer $\checkmark$ reason	(2)
3.2.1	17 blocks	$\checkmark 17$	(1)
3.2.2	$T_n = 3n + 5$	$\checkmark 3n$ $\checkmark +5$	(2)
3.2.3	No. of blocks required to make the 100 th E: $3(100) + 3 = 305$	$\checkmark$ substitution $\checkmark$ answer N.B. Answer only: full marks	(2)
3.2.4	$3n+5=116$ $3n=111$ $n=37$ The 37 th E can be made from 116 blocks	$\checkmark 3n+5=116$ $\checkmark$ simplification $\checkmark$ answer	(3)

[12]

QUESTION 4

$f(x) = x - 2$ and $g(x) = \frac{4}{x} - 2$	$\checkmark$ x-intercepts of f : (2; 0) $\checkmark$ y-intercept of f : (0; -2) $\checkmark$ x-intercept of g : (2; 0) $\checkmark$ asymptote of g : $y = -2$ $\checkmark$ another point on g eg. (1; 2), (4; -1), (-2; -4), (-1; -6), etc. $\checkmark$ shape of g i.e. hyperbola predominately in quadrants 1 and 3.
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[6]

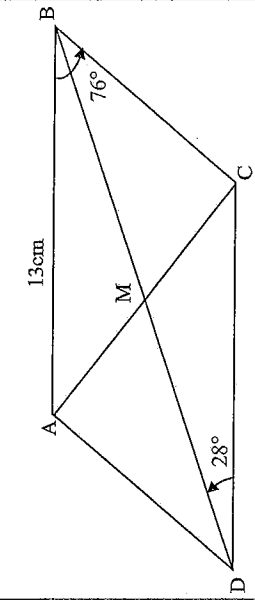
QUESTION 5

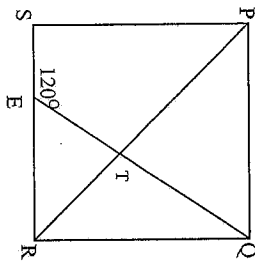
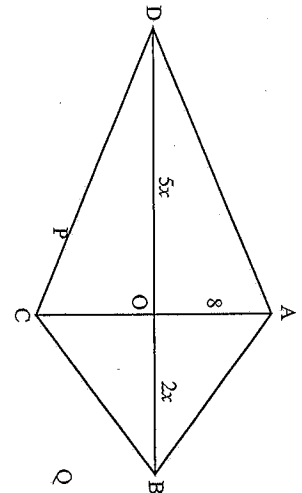
$f(x) = -4x^2 + 9$ and $g(x) = 2x + 3$.	
5.1	$C(0; 3)$
5.2	x -intercepts of f : $0 = -4x^2 + 9$ $4x^2 - 9 = 0$ $(2x - 3)(2x + 3) = 0$ $x = \frac{3}{2}$ or $x = -\frac{3}{2}$ $AB = 3$ units
5.3	$DE = 2(1) + 3$ $DE = 5$ units
5.4	$-1\frac{1}{2} < x < 1$ OR $x \in \left(-1\frac{1}{2}; 1\right)$
5.5	$AD^2 = \left(2\frac{1}{2}\right)^2 + 5^2$ (Pythagoras) $AD^2 = \frac{125}{4}$ $AD = \frac{\sqrt{125}}{2}$ or $\frac{5\sqrt{5}}{2}$ or 5,59
[10]	

QUESTION 6

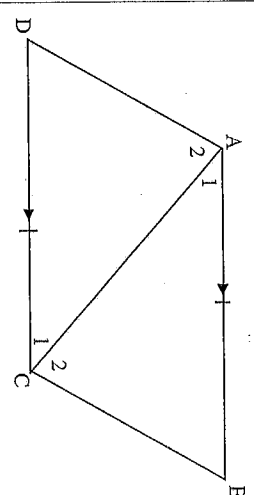
$g(x) = b^x + c$ and $h(x) = \frac{k}{x}$. A, the point of intersection, is $(1; 1)$.	
6.1	$k = 1$ $c = \frac{1}{2}$ $1 = b^1 + \frac{1}{2}$ $b = \frac{1}{2}$
6.2	$y = \frac{1}{2}$ $\checkmark$ answer
6.3	Domain of h : $\{x \mid x \in \mathbb{R}; x \neq 0\}$
6.4	$g(x) = b^{-x} + c$ $g(x) = \left(\frac{1}{2}\right)^{-x} + \frac{1}{2}$ OR $g(x) = 2^x + \frac{1}{2}$
[9]	

QUESTION 7

7.1	
7.1.1	$DC = 13\text{cm}$ (opp sides of parm are equal) $\checkmark$ S $\checkmark$ R
7.1.2	$\widehat{ADM} + 28^\circ = 76^\circ$ $\widehat{ADM} = 76^\circ - 28^\circ = 48^\circ$ (opp angles of parm are equal) $\checkmark$ S/R $\checkmark$ answer
[2]	

7.2		
7.2.1	The diagonals of a square bisect the vertex angles.	✓ reason (1)
7.2.2	$P\hat{T}E + 45^\circ + 90^\circ + 120^\circ = 360^\circ$ (sum of angles in quad) $P\hat{T}E = 360^\circ - 255^\circ$ $= 105^\circ$	✓ S/R ✓ answer (2)
7.3		
7.3.1	OC = 8cm (diagonals of a kite)	✓ S ✓ R (2)
7.3.2	$\text{Area of kite} = \frac{1}{2}(AC)(BD)$ $= \frac{1}{2}(16)(7x)$ S $= 56x$ E R 120°	✓ $\frac{1}{2}(16)(7x)$ ✓ answer (2)
7.3.3	$56x = 168$ $x = 3$	✓ S ✓ answer (2)
7.3.4	$OB = 6\text{cm}$ $A\hat{O}B = 90^\circ$ $AB^2 = 6^2 + 8^2$ $= 100$ $AB = 10$ (diagonals of a kite) (Theorem of Pythagoras)	✓ S ✓ S/R ✓ answer with reason (3)
		[16]

QUESTION 8

8.1	 Constr: Draw diagonal AC Proof: In $\triangle ABC$ and $\triangle CDA$ (i) AC is common (given) (ii) $AB = DC$ (alt angles $AB \parallel DC$) (iii) $\hat{A}_1 = \hat{C}_1$ (alt angles $AD \parallel BC$) $\triangle ABC \cong \triangle CDA$ (S ; $\angle$; S) $\therefore \hat{A}_2 = \hat{C}_2$ These are alternate angles $\therefore AD \parallel BC$ $\therefore ABCD$ is a parallelogram (both pairs of opp sides are parallel)	✓ constr ✓ $\triangle ABC \cong \triangle CDA$ (S ; $\angle$; S) ✓ $\hat{A}_2 = \hat{C}_2$ ✓ $AD \parallel BC$ ✓ R (5)
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8.2			
8.2.1	Diagonals bisect each other	✓ reason	(1)
8.2.2	In $\triangle QCR$, $CD = DR$ (line drawn from the midpoint of one side, parallel to the 2nd side, bisects the 3rd side) In $\triangle PAD$, $PC = CD$ (line drawn from the midpoint of one side, parallel to the 2nd side, bisects the 3rd side) $\therefore PC = CD = DR$	✓ S ✓ R ✓ S ✓ R	(4)
8.2.3	In $\triangle PAD$ $BC = \frac{1}{2} AD$ (midpoint theorem) $2BC = AD$ $\therefore GC = AD$ But $GC \parallel AD$ (given) $\therefore GCAD$ is a parallelogram (one pair of opp sides equal and parallel)	✓ S ✓ R ✓ S ✓ R	(4)
			[14]

TOTAL MARKS: 100

