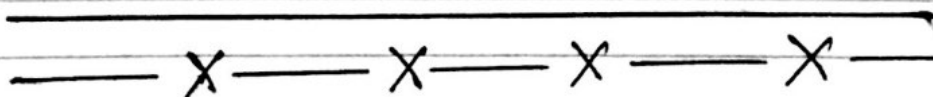


Contents

1. Change of subject of a formula, Factorization, Algebraic fractions, Solution of linear equations and inequations and Solution of quadratic equations, Algebraic indices, Variations.
 Questions No - 1, 5, 8, 12, 15, 18, 21, 23, 26, 27, 31, 35, 38, 39, 49, 45, pages - 28
and pages 29-29.
all questions
2. Sequences:
 Questions No - 7, 10, 16, 29, 43 and pages - 30-37
all questions
3. Linear Programming:
 Questions No — 3, 6, 34, 42 and pages - 38-39
all ques.
4. Simple functions and Composite functions
 Question No - 13, 19, 22, 25, 32, 36 } page - 16-28
 and 89, 91, 95, 97, 99, 101, 103, 105, 107 }
 110, 115 } → pages - 40-51
5. Graph of Functions:
 Question No - 2, 4, 9, 11, 14, 17, 20, } - pages - 1-28
 24, 28, 30, 33, 37, 40, 44. }
 and 88, 90, 92, 93, 94, 96, 98, }
 100, 102, 104, 106, 108, 109, 111, } → pages - 40-51
 112, 113, 114.
6. Answers: pages - 52-61



Q1 (a) Find the integer values of x which satisfy the inequality:
 $-3 < 2x - 1 \leq 6$ --- [3]

(b) Simplify: $\frac{x^2 + 3x - 10}{x^2 - 25}$ --- [4]

(c) (i) Show that $\frac{5}{x-3} + \frac{2}{x+1} = 3$ can be simplified to,
 $3x^2 - 13x - 8 = 0$ --- [3]

(ii) Solve the equation $3x^2 - 13x - 8 = 0$, show all your working and give your answers correct to two decimal places. --- [4]

SP-15/04/Q2

Q2 Complete the table for the function, $f(x) = \frac{x^3}{2} - 3x - 1$

x	-3	-2	-1.5	-1	0	1	1.5	2	3	3.5
$f(x)$	-5.5		1.8	1.5		-3.5	-3.8	-3		9.9

(b) On the grid draw the graph of $y = f(x)$ for $-3 \leq x \leq 3.5$ --- [3]

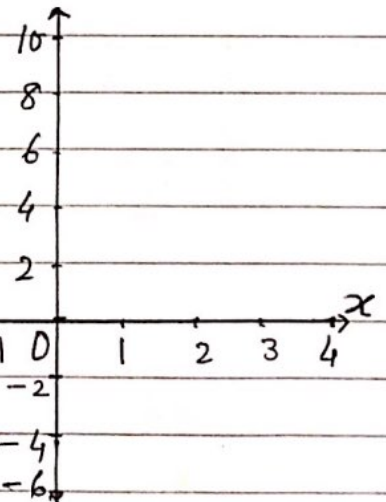
(c) Use your graph to

(i) solve $f(x) = 0.5$ --- [3]

(ii) find the inequalities for k , so that $f(x) = k$ has only 1 answer.

Ans; $k < \dots$

$k > \dots$ --- [2]



(d) (i) On the same grid, draw the graph of,
 $y = 3x - 2$ for $-1 \leq x \leq 3.5$ --- [3]

(ii) The equation $\frac{x^3}{2} - 3x - 1 = 3x - 2$ can be written in the form $x^3 + ax + b = 0$. Find the values of a and b . --- [2]

(iii) Use your graph to find the positive answers to,

$$\frac{x^3}{2} - 3x - 1 = 3x - 2 \text{ for } -3 \leq x \leq 3.5 \text{ --- [2]}$$

SP-15/04/Q5

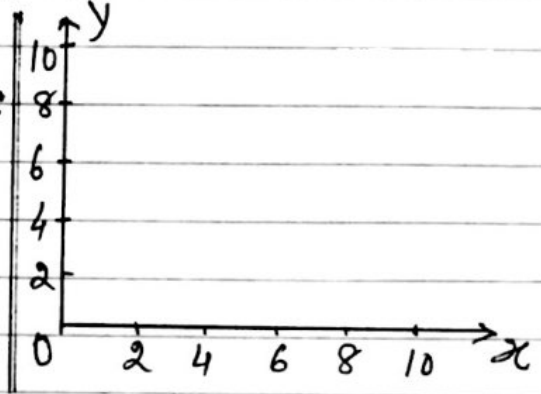
Q3 Mr Chang hires x large coaches and y small coaches to take 300 students on a school trip. Large coaches can carry 50 students and small coaches 30 students.

There is a maximum of 5 large coaches.

(a) Explain clearly how the following two inequalities satisfy these conditions:

(i) $x \leq 5$ ----- [1]

(ii) $5x + 3y \geq 30$ ----- [2]



Mr Chang also knows that $x + y \leq 10$

(b) On the grid, show the information above by drawing three straight lines and shading the unwanted regions. [5]

(c) A large coach costs \$450 to hire and a small coach costs \$350.

(i) Find the number of large coaches and the number of small coaches that would give the minimum hire cost for the school trip. ----- [2]

(ii) Calculate the minimum cost. SP-15/04/Q8 ----- [1]

Q4. The table shows some values for $y = 1.5^x - 1$.

x	-2	-1	0	1	2	3	4	5
y	-0.56	-0.33				2.38	4.06	6.59

(a) Complete the table. M-17/42/Q3 ----- [3]

(b) Draw the graph of $y = 1.5^x - 1$ for $-2 \leq x \leq 5$. ----- [4]

(c) Use your graph to solve the equation, $1.5^x - 1 = 3.5$ ----- [2]

(d) By drawing a suitable straight line, solve the equation $1.5^x - x - 2 = 0$ ----- [1]

(e) (i) On the grid plot the point $A(5, 5)$, (ii) draw the tangent to the graph of $y = 1.5^x - 1$, that passes through the point A , ----- [1]

(iii) Work out the gradient of this tangent. ----- [2]

Q5 (a) (i) Factorise $3x^2 + 11x - 4$ --- [2]

(ii) Solve the equation $3x^2 + 11x - 4 = 0$ --- [1]

b (i) Show that, $\frac{2}{2x+11} - \frac{1}{x-4} = \frac{1}{2}$ M-17/42/Q5

simplifies to $2x^2 + 3x - 6 = 0$ --- [4]

(ii) Solve the equation $2x^2 + 3x - 6 = 0$, you must show all your working and give your answers correct to 2 decimal places. --- [4]

Q.6 Bernie buys x packets of seeds and y plants for his garden. He wants to buy more packets of seeds than plants. The inequality $x > y$ shows this information.

He also wants to buy,

- less than 10 packets of seeds
- at least 2 plants

(a) Write down 2 more inequalities in x or y to show this information. --- [2]

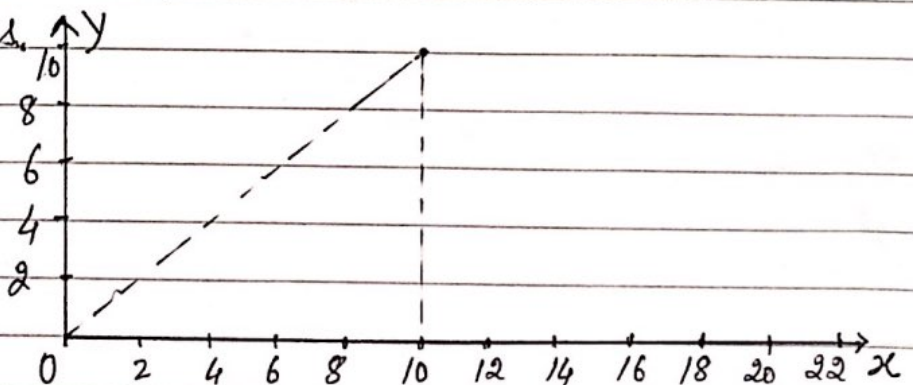
(b) Each packet of seeds costs \$1 and each plant costs \$3.

The maximum amount Bernie can spend is \$21.

Write down another inequality in x and y to show this information. --- [1]

(c) The line $x = y$ is drawn on the grid.

Draw three more lines to show your inequalities and shade the unwanted regions. --- [5]



(d) Bernie buys 8 packets of seeds.

(i) Find the maximum number of plants he can buy. --- [1]

(ii) Find the total cost of these packets of seeds and plants. --- [1]

M-17/42/Q9

Q7 On Monday, Ankuri sent this text message to two friends.
Today is Day Number 1.
Tomorrow, please add 1 to the day Number and send this message to two friends.
All friends who receive a text message follow the instruction,

(a) Complete the table: ---[4]

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Day Number	1	2	3				
Number of text messages sent today.	2	4					

(b) Write down an expression for the number of text messages sent on Day Number n . ---[1]

(c) Ankuri thinks that, by the end of Day Number 3, the total number of text messages that have been sent is $2^4 - 2$

(i) Show that she is correct. ---[2]

(ii) Complete the statement:

The total number of text messages sent by the end of Day Number 5 is --- which is equal to $2^k - 2$, where $k =$ ---

(iii) Write an expression for the total number of text messages sent by the end of Day Number n . ---[1]

(iv) Find the day Number when the total number of text messages by the end of the day is 1022, [M-17/42/Q11] ---[1]

Q8 (a) Expand the brackets and simplify:

(i) $4(2x+5) - 5(3x-7)$ ---[2]

(ii) $(x-7)^2$ ---[2]

(b) Solve (i) $\frac{2x}{3} + 5 = -7$ ---[3]

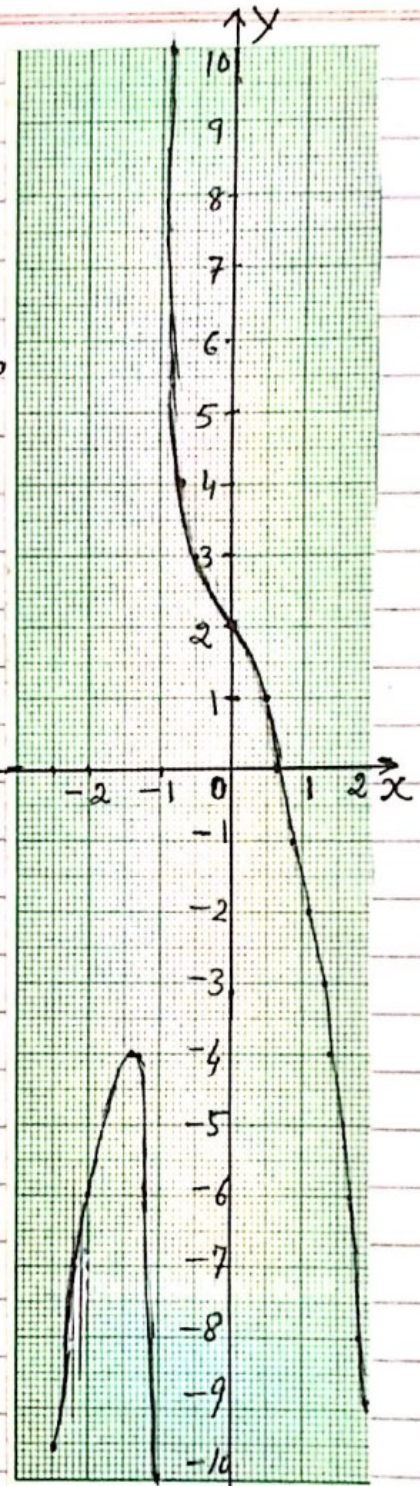
(ii) $4x+9 = 3(2x-7)$ ---[3]

(iii) $3x^2 - 1 = 74$ [3]

[S-17/41/Q6]

Q 9 The diagram shows the graph of $y = f(x)$
for $-2.5 \leq x \leq 2$

- (a) Find $f(1)$ ----- [1]
 (b) Solve $f(x) = 3$ ----- [1]
 (c) The equation $f(x) = k$ has only one solution
 for $-2.5 \leq x \leq 2$. Write down the range of values
 of k for which this is possible. --- [2]
 (d) By drawing a suitable line, solve
 the equation $f(x) = (x-5)$ --- [3]
 (e) Draw a tangent to the graph of $y = f(x)$, at the
 point where $x = 1$,
 Use your tangent to estimate the gradient
 of $y = f(x)$ when $x = 1$. --- [3]



Q 10 (a) The n th term of a sequence is $8n - 3$.

(i) Write down the first two terms of the sequence. --- [1]

(ii) Show that the number 203 is not in this sequence. --- [2]

(b) Find the n th term of these sequences:

(i) 13, 19, 25, 31, --- [2]

(ii) 4, 8, 14, 22, --- [2]

(c) The second term of a sequence is 20 and the third term is 50.

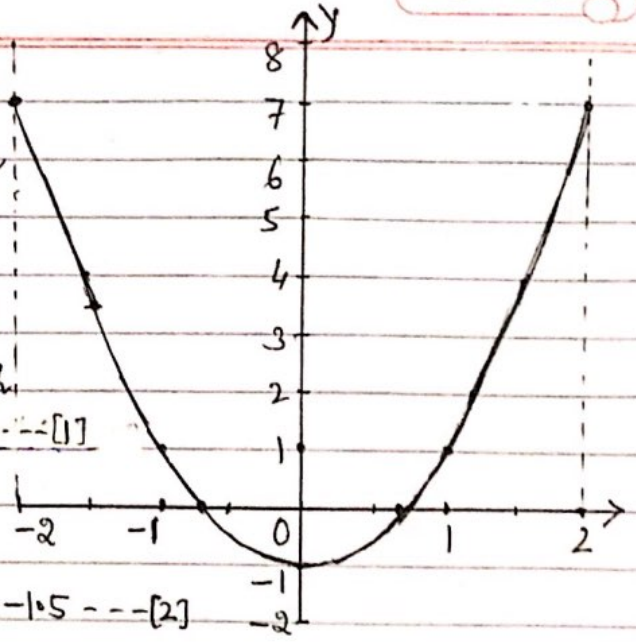
The rule for finding the next term in this sequence is subtract y and then multiply by 5.

Find the value of y and work out the first term of this sequence. --- [4]

[S-17/41/Q9]

Q 11 $f(x) = 2x^2 - 1$

The graph of $y = f(x)$, for $-2 \leq x \leq 2$, is drawn on the grid.



(a) Use the graph to solve the equation $f(x) = 5$ --- [2]

(b) (i) draw the tangent to the graph of $y = f(x)$ at the point $(-1.5, 3.5)$ --- [1]

(ii) Use your tangent to estimate the gradient of $y = f(x)$ when $x = -1.5$ --- [2]

(c) $g(x) = 2^x$

(i) Complete the table for $y = g(x)$ --- [1]

x	-2	-1	0	1	2
y	0.25	0.5		2	4

(ii) On the grid opposite, draw the graph of $y = g(x)$ for $-2 \leq x \leq 2$ --- [3]

(d) Use your graph to solve.

(i) the equation $f(x) = g(x)$ --- [2]

(ii) the inequality $f(x) < g(x)$ --- [1]

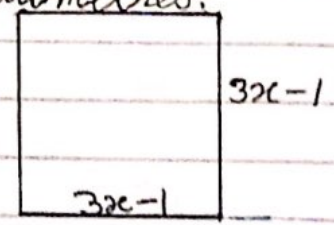
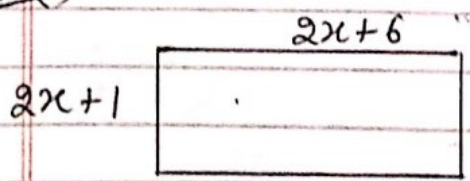
(e) (i) Write down the three values:

$g(-3) = \dots$ $g(-5) = \dots$ $g(-10) = \dots$ [1]

(ii) Complete the statement,

As x decreases, $g(x)$ approaches the value \dots [1]

Q12(a) In this part, all lengths are in centimetres: [5-17/42/Q4]



(i) Find the value of x when the perimeter of the rectangle is equal to the perimeter of the square. --- [3]

(ii) Find the value of x when the area of the rectangle is equal to the area of the square. Show all your working. (continued \rightarrow) --- [7]

(Continued →)

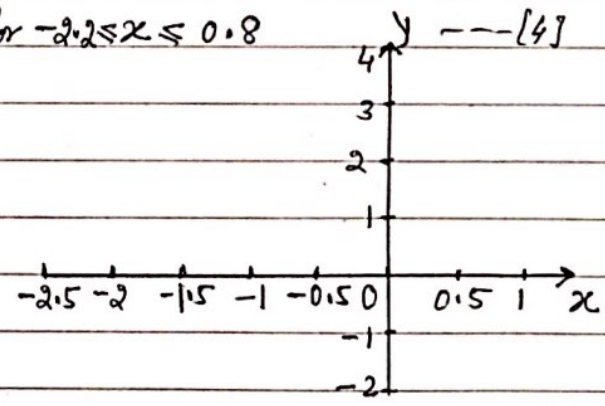
- Q12 (b) (i) Factorise $x^2 + 4x - 5$ --- [2]
 (ii) Solve the equation $\frac{5}{x} - \frac{8}{x+1} = 1$, show all your working. --- [4]

S-17/42/Q7

- Q13 $f(x) = 3x - 2$ $g(x) = x^2$ $h(x) = 3^x$
- (a) Find $f(-3)$ --- [1]
 (b) Find the value of x when $f(x) = 19$ --- [2]
 (c) Find $fh(2)$ --- [2]
 (d) Find $gf(x) + f(x) + x$
 Give your answer in its simplest form. --- [3]
 (e) Find $f^{-1}(x)$. S-17/42/Q10 --- [2]

Q14 The table shows some values for $y = 2x^3 + 4x^2$

x	-2.2	-2	-1.5	-1	-0.5	0	0.5	0.8
y	-1.94				0.75	0		3.58

- (a) Complete the table. --- [4]
 (b) Draw the graph of $y = 2x^3 + 4x^2$ for $-2.2 \leq x \leq 0.8$ --- [4]
- 
- (c) Find the number of solutions of the equation $2x^3 + 4x^2 = 3$ --- [1]
 (d) (i) The equation $2x^3 + 4x^2 - x = 1$ can be solved by drawing a straight line on the grid. Write down the equation of this straight line. --- [1]
 (ii) Use your graph to solve the equation $2x^3 + 4x^2 - x = 1$ --- [3]
 (e) The tangent to the graph of $y = 2x^3 + 4x^2$ has a negative gradient when $x = k$. Complete the inequality for k . $--- < k < ---$ --- [2]

S-17/43/Q3

- Q15 (a) Solve the simultaneous equation. You must show all your working:
 $2x + 3y = 11$
 $3x - 5y = -50$ --- [4]
- (b) $x^2 - 12x + a = (x+b)^2$
 Find the value of a and the value of b . (Continued →) --- [3]

(Continued →)

Q15(c) Write a single fraction in its simplest form:

$$\frac{x}{2x-5} + \frac{3x+2}{x-1}$$

---[4]

S-17/43/Q7

Q16 The table shows the first four terms in sequences A, B, C and D. Complete the table.

Sequence	1st Term	2nd Term	3rd Term	4th Term	5th Term	nth Term
A	16	25	36	49		
B	5	8	11	14		
C	11	17	25	35		
D	$\frac{3}{2}$	$\frac{4}{3}$	$\frac{5}{4}$	$\frac{6}{5}$		

S-17/43/Q11 ---[12]

Q17 The table shows some values of $y = x + \frac{1}{x^2}$, $x \neq 0$

x	-2	-1.5	-1	-0.75	-0.5	0.5	0.75	1	1.5	2	3
y	-1.75	-1.06	0	1.03		4.50	2.53	2		2.25	

(a) Complete the table of values.

---[3]

(b) On the grid, draw the graph of $y = x + \frac{1}{x^2}$ for $-2 \leq x \leq -0.5$ and $0.5 \leq x \leq 3$.

(c) Use your graph to solve the equation,

$$x + \frac{1}{x^2} = 1.5$$

---[1]

(d) The line $y = ax + b$ can be drawn on the grid to solve the equation $\frac{1}{x^2} = 2.5 - 2x$

(i) Find the value of a and the value of b.

---[2]

(ii) Draw the line $y = ax + b$ to solve the equation $\frac{1}{x^2} = 2.5 - 2x$

---[3]

(e) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where $x = 2$.

---[3]

M-16/42/Q7

Q18 (a) y is directly proportional to the positive square root of $(x+2)$.
When $x=7$, $y=9$; Find y when $x=23$ --- [3]

(b) Simplify,
$$\frac{x^2+12x+36}{x^2+4x-12}$$
 --- [5]

(c) $W = \sqrt{\frac{x-a}{a}}$, Make a the subject of the formula. --- [5]

(d) Write as a single fraction in its simplest form,
$$\frac{x-2}{x+1} - \frac{x+3}{x-1}$$
 --- [5]

M-16/42/Q8

Q19 $f(x) = 2-3x$ $g(x) = 7x+3$

(a) Find
(i) $f(-3)$ --- [1]

(ii) $g(2x)$ --- [1]

(b) Find $gf(x)$ in its simplest form. --- [2]

(c) Find x when $3f(x) = 7$ --- [3]

(d) Solve the equation, $f(x+4) - g(x) = 0$ --- [3]

M-16/42/Q11

Q20 $f(x) = \frac{20}{x} + x$, $x \neq 0$

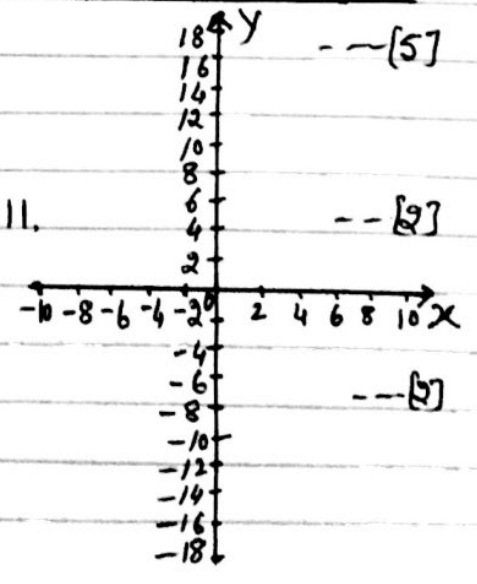
(a) Complete the table. --- [2]

x	-10	-8	-5	-2	-1.6	1.6	2	5	8	10
$f(x)$	-12	-10.5	-9	-12	-14.1	14.1	12			12

(b) On the grid, draw the graph of $y = f(x)$,
for $-10 \leq x \leq -1.6$ and $1.6 \leq x \leq 10$ --- [5]

(c) Using your graph, solve the equation $f(x) = 11$. --- [2]

(d) k is a prime number and $f(x) = k$ has no solution. Find the possible values of k . --- [2]



(Continued →)

(Continued →)

Q20(e) The gradient of the graph of $y=f(x)$ at the point $(2,12)$ is -4 . Write down the co-ordinates of the other point on the graph of $y=f(x)$ where the gradient is -4 . --- [1]

(f) (i) The equation $f(x)=x^2$ can be written as $x^3+px^2+q=0$

Show that $p=-1$ and $q=-20$ --- [2]

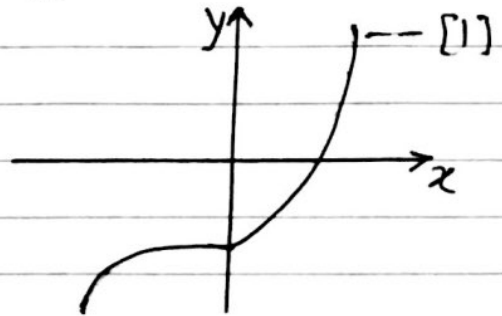
(ii) On the grid opposite, draw the graph of $y=x^2$ for $-4 \leq x \leq 4$. --- [2]

(iii) Using your graph, solve the equation $x^3-x^2-20=0$ --- [1]

(iv) The diagram shows a sketch of the graph of $y=x^3-x^2-20$

P is point $(n,0)$.

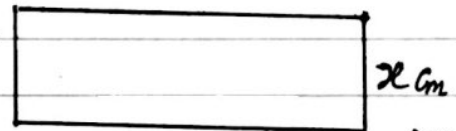
Write down the value of n .



S-16/41/Q5

Q21(a) The perimeter of the rectangle is 80 cm.

The area of the rectangle is $A \text{ cm}^2$.



(i) Show that $x^2-40x+A=0$ --- [3]

(ii) When $A=300$, solve, by factorisation the equation:

$$x^2-40x+A=0 \quad \text{--- [3]}$$

(iii) When $A=200$, solve, using the quadratic formula, the equation

$x^2-40x+A=0$, show all your working and give your answers correct to 2 decimal places. --- [4]

(b) A car completes a 200 km journey with an average speed of $x \text{ km/h}$. The car completes the return journey of 200 km with an average speed of $(x+10) \text{ km/h}$.

(i) Show that the difference between the time taken for each of the two journeys is $\frac{2000}{x(x+10)}$ hours. --- [3]

(ii) Find the difference between the time taken for each of the two journeys when $x=80$. Give your answer in minutes and seconds. [3]

S-16/41/Q6

- Q22 $f(x) = 2x + 1$ $g(x) = x^2 + 4$ $h(x) = 2^x$
- (a) Solve the equation $f(x) = g(1)$ --- [2]
 - (b) Find the value of $fh(3)$ --- [2]
 - (c) Find $f^{-1}(x)$ --- [2]
 - (d) Find $gf(x)$ in its simplest form. --- [3]
 - (e) Solve the equation $h^{-1}(x) = 0.5$ --- [1]
 - (f) $\frac{1}{h(x)} = 2^{kx}$, write down the value of k . --- [1]

S-16/41/Q8

Q23 (a) Work out the value of x in each of the following:

- (i) $3^x = 243$ --- [1]
- (ii) $16^x = 4$ --- [1]
- (iii) $8^x = 32$ --- [2]
- (iv) $27^x = \frac{1}{9}$ --- [2]

(b) Solve by factorisation: $y^2 - 7y - 30 = 0$
Show your working. --- [3]

S-16/42/Q2

Q24 $f(x) = x^2 - \frac{1}{x} - 4$, $x \neq 0$

(a)(i) Complete the table: --- [2]

x	-3	-2	-1	-0.5	-0.1	0.2	0.5	1	2	3
$f(x)$	5.3	0.5		-1.8	6.0	-9.0	-5.8	-4		4.7

(ii) On the grid, draw the graph of $y = f(x)$,
for $-3 \leq x \leq -0.1$ and $0.2 \leq x \leq 3$ --- [5]

(b) Use your graph to solve the equation $f(x) = 0$ --- [3]

(c) Find an integer k , for which $f(x) = k$ has one solution. --- [1]

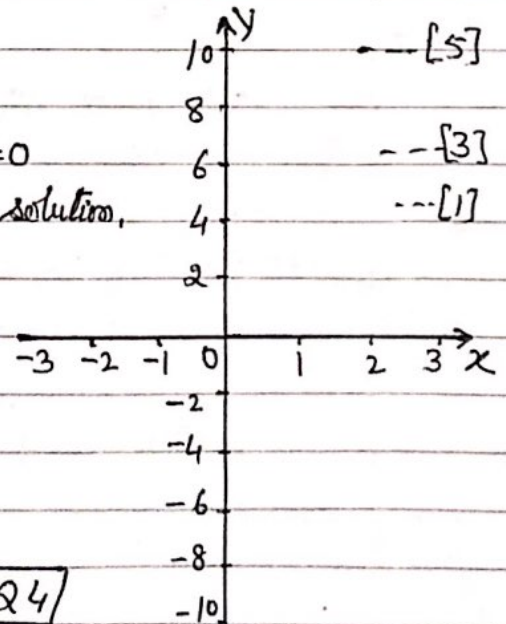
(d)(i) By drawing a suitable straight line,
solve the equation $f(x) + 2 = -5x$ --- [4]

(ii) $f(x) + 2 = -5x$ can be written

as $x^3 + ax^2 + bx - 1 = 0$

Find the value of a and b . --- [2]

S-16/42/Q4



Q25 $f(x) = 5x + 7$ $g(x) = \frac{4}{x-3}, x \neq 3$

- (a) Find,
- (i) $fg(1)$ --- [2]
 - (ii) $gf(x)$ --- [2]
 - (iii) $g^{-1}(x)$ --- [3]
 - (iv) $f^{-1}f(2)$ --- [1]

- (b) $f(x) = g(x)$
- (i) Show that $5x^2 - 8x - 25 = 0$ --- [3]
 - (ii) Solve $5x^2 - 8x - 25 = 0$, Show all your working and give your answers correct to 2 decimal places. --- [4]

5-16/42/Q8

- Q26 (a) Solve the inequality; $5x - 3 > 9$ --- [2]
- (b) Factorise completely: (i) $xy - 18 + 3y - 6x$ --- [2]
- (ii) $8x^2 - 72y^2$ --- [3]
- (c) Make x the subject of the formula; $p + 5 = \frac{1 - 2x}{x}$ --- [4]

5-16/43/Q2

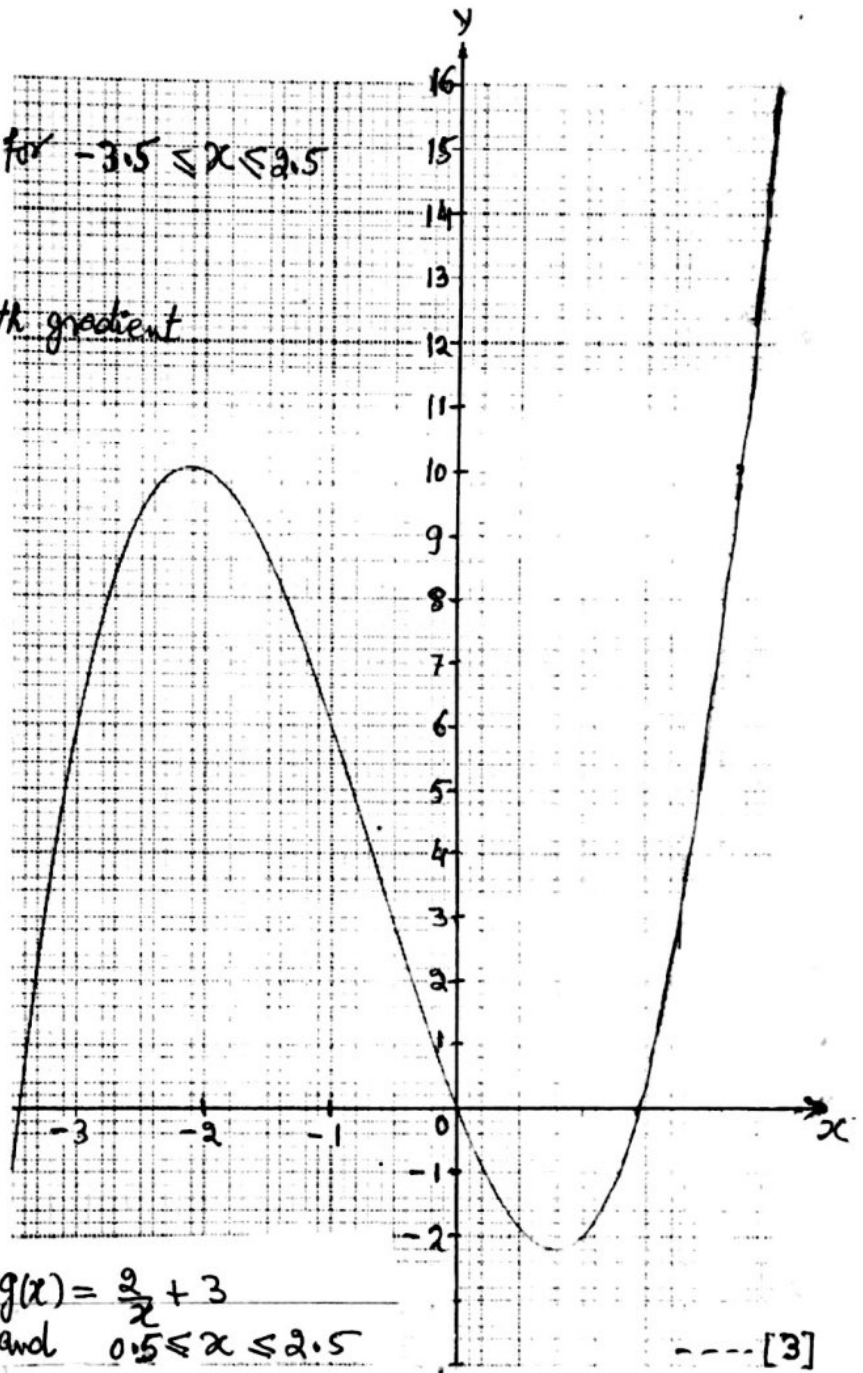
Q27 Alfonso runs 10km at an average speed of x km/h. The next day he runs 12 km at an average speed of $(x-1)$ km/h. The time taken for the 10km run is 30 minutes less than the time taken for the 12 km run.

- (a) (i) Write down an equation in x and show that, it simplifies to $x^2 - 5x - 20 = 0$ --- [4]
- (ii) Use quadratic formula to solve the equation $x^2 - 5x - 20 = 0$. Show your working and give your answers correct to 2 decimal places. --- [4]
- (iii) Find the time that Alfonso takes to complete the 12 km run. Give your answer in hours and minutes correct to the nearest minute. --- [2]

5-16/43/Q7(a)

Q28. The diagram shows the graph of $y = f(x)$ for $-3.5 \leq x \leq 2.5$

- (a) (i) Find $f(-2)$ --- [1]
 (ii) Solve $f(x) = 2$ --- [3]
 (iii) Two tangents each with gradient 0, can be drawn to the graph of $y = f(x)$. Write down the equation of each tangent. --- [2]



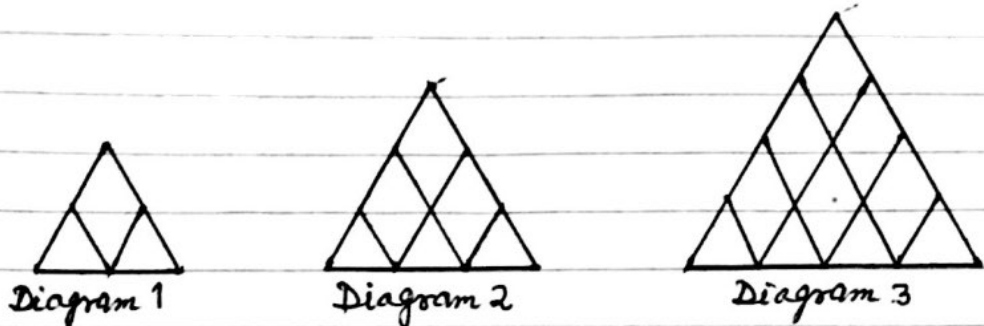
(b) Complete the table for $g(x) = \frac{x}{2} + 3$ for $-3.5 \leq x \leq -0.5$ and $0.5 \leq x \leq 2.5$ --- [3]

x	-3.5	-3	-2	-1	-0.5	0.5	1	2	2.5
$g(x)$	2.4	2.3		1		7	5		3.8

- (ii) On the grid opposite, draw the graph of $y = g(x)$ --- [4]
 (iii) Use your graph to solve the equation $f(x) = g(x)$ --- [2]
 (c) Find $gf(-2)$ --- [2]
 (d) Find $g^{-1}(5)$ --- [1]

5-16/43 Q3

Q29



Each diagram is made from tiles in the shape of equilateral triangles and rhombuses. The length of a side of each tile is 1 unit.

(a) Complete the table below for this sequence of diagrams. --- [6]

Diagram	1	2	3	4	5
Number of equilateral triangle shaped tiles.	2	3	4	5	6
Number of rhombus shaped tiles	1	3	6		
Total number of tiles	3	6	10		
Number of 1 unit lengths	8	15	24		

- (b) (i) The number of 1 unit length in Diagram n is $n^2 + 4n + p$
Find the value of p . --- [2]
- (ii) Calculate the number of 1 unit lengths in Diagram 10 --- [1]
- (c) The total number of tiles in Diagram n is $an^2 + bn + 1$
Find the value of a and the value of b . --- [5]
- (d) Part of Louvre museum in Paris is in the shape of a square-based pyramid made from glass tiles. Each of the triangular faces of the pyramid is represented by Diagram 17 in the sequence.
- (i) Calculate the total number of glass tiles on one triangular face of this pyramid. --- [2]
- (ii) 11 tiles are removed from one of the triangular faces to create an entrance into the pyramid.
Calculate the total number of glass tiles used to construct this pyramid. --- [1]

S-16/43/Q10

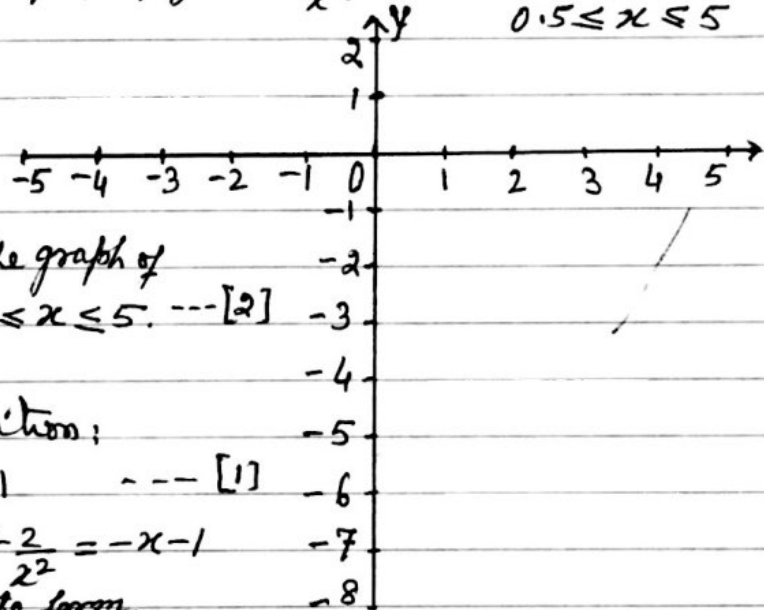


Q30 $y = 1 - \frac{2}{x^2}, x \neq 0$

(a) Complete the table: --- [3]

x	-5	-4	-3	-2	-1	-0.5	0.5	1	2	3	4	5
y		0.88	0.78			-7	-7			0.78	0.88	

(b) On the grid, draw the graph of $y = 1 - \frac{2}{x^2}$ for $-5 \leq x \leq 5$ and $0.5 \leq x \leq 5$ and --- [5]



(c) (i) On the grid, draw the graph of $y = -x - 1$ for $-3 \leq x \leq 5$. --- [2]

(ii) Solve the equation:

$$1 - \frac{2}{x^2} = -x - 1 \quad \text{--- [1]}$$

(iii) The equation $1 - \frac{2}{x^2} = -x - 1$ can be written in the form,

$$x^3 + px^2 + q = 0, \text{ Find the value } p \text{ and the value of } q. \quad \text{--- [3]}$$

(d) The graph of $y = 1 - \frac{2}{x^2}$ cuts the positive x-axis at A. B is the point (0, -2).

(i) Write down the co-ordinate of A. --- [1]

(ii) On the grid, draw the straight line that passes through A and B --- [1]

(iii) Complete the statement.

The straight line that passes through A and B is ---
at the point --- [2]

W-16/41/24

Q31 Apples cost x cents each and oranges cost $(x+2)$ cents each. Dylan spends \$3.23 on apples and \$3.23 on oranges. The total of the number of apples and the number of oranges Dylan buys is 36.

(a) Write an equation in x and show that it simplifies to,

$$18x^2 - 287x - 323 = 0 \quad \text{--- [4]}$$

(Continued →)

(Continued →)

- Q31 (b) (i) Find two prime factors of 323. --- [1]
 (ii) Complete the statement.
 $18x^2 - 287x - 323 = (18x - \dots)(x - \dots)$ --- [2]
 (iii) Solve the equation $18x^2 - 287x - 323 = 0$ --- [1]
 (c) Find the largest number of apples Dylan can buy for \$2. --- [1]

W-16/41/Q8

- Q32 $f(x) = 2x + 1$ $g(x) = 3x - 2$ $h(x) = 3^x$
- (a) Find $hf(2) - fh(2)$ --- [3]
 (b) Find $gf(x)$, giving your answer in its simplest form. --- [2]
 (c) Solve the inequality $f(x) > g(x)$ --- [2]
 (d) Solve the equation $h(x) = \frac{1}{9}$ --- [1]
 (e) Find $g^{-1}(x)$ --- [2]
 (f) Find $\frac{5}{f(x)} + g(x)$; Give your answer as a single fraction. --- [3]
 (g) Solve the equation $f^{-1}(x) = 4$ --- [1]

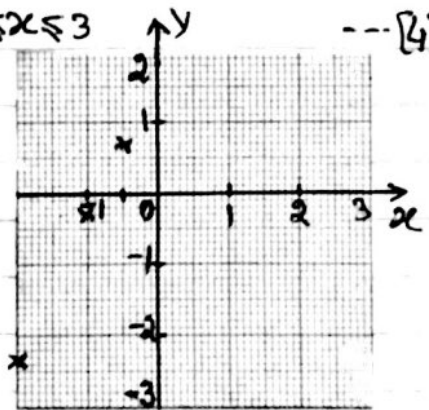
W-16/41/Q9

- Q33(a) Complete the table of values for $y = \frac{x^3}{3} - x^2 + 1$ --- [2]

x	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3
y	-2.38	-0.33	0.71		0.79	0.33	-0.13	-0.33	-0.04	

- (b) Draw the graph of $y = \frac{x^3}{3} - x^2 + 1$ for $-1.5 \leq x \leq 3$ --- [4]

The first 3 points have been plotted for you.



- (c) Using your graph, solve the equations.

(i) $\frac{x^3}{3} - x^2 + 1 = 0$ --- [3]

(ii) $\frac{x^3}{3} - x^2 + x + 1 = 0$ --- [2]

- (d) Two tangents to the graph of $y = \frac{x^3}{3} - x^2 + 1$ can be drawn parallel to the x -axis.

(i) Write down the equation of each of those tangents. --- [2]

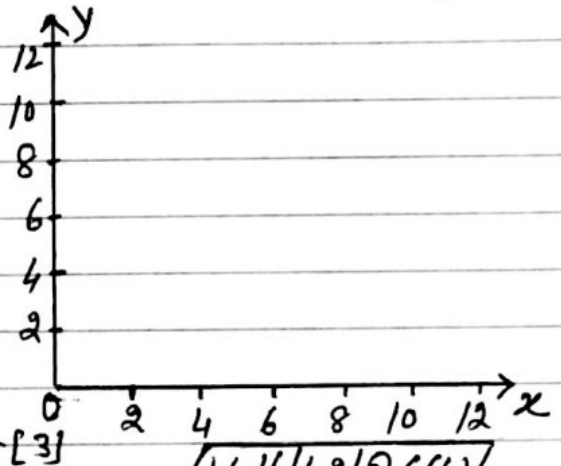
(ii) For $0 \leq x \leq 3$, write down the smallest possible value of y . --- [1]

W-16/42/Q2

Q34. A bag of sweets contains x orange sweets and y lemon sweets. Each orange sweet costs 2 cents and each lemon sweet costs 3 cents. The cost of a bag of sweets is less than 24 cents. There are at least 9 sweets in each bag. There are at least 2 lemon sweets in each bag.

(i) One of the inequalities that shows this information is $2x + 3y < 24$. Write down the other two inequalities. --- [2]

(ii) On the grid, by shading the unwanted region, show the region which satisfy the three inequalities. --- [4]



(iii) Find the lowest cost of a bag of sweets. Write down the value of x and the value of y that give this cost. --- [3]

Q35 (a) \$1 = 3.67 dishams Calculate the value, in dollars, of 200 dishams. Give your answer correct to 2 decimal places. --- [2]

(b) (i) Write as a single fraction, in its simplest form; --- [3]

$$\frac{1000}{x} - \frac{1000}{x+1}$$

(ii) one day in 2014, 1 euro was worth x rand. one year later, 1 euro was worth $(x+1)$ rand. Winston changed 1000 rands into euros in both years. In 2014 he received 4.50 euros more than in 2015.

Write an equation in terms of x and show that it simplifies to

$$9x^2 + 9x - 2000 = 0 \quad \text{--- [3]}$$

(iii) Use quadratic formula to solve the equation $9x^2 + 9x - 2000 = 0$

Show all your working and give your answers correct to 2 decimal places. --- [4]

(iv) Calculate the number of euros Winston received in 2014.

Give your answer correct to 2 decimal places, --- [2]

W-16/42/Q7

Q36(a) $y = \frac{3}{x} + 2, x \neq 0$

(i) Find the value of y when $x = -6$ --- [1]

(ii) Find x in terms of y . --- [3]

(b) $g(x) = 2 - x$ $h(x) = 2^x$

(i) Find $g(5)$ -- [1]

(ii) Find $h(h(2))$ --- [2]

(iii) Find x when $g(x) = h(3)$ -- [3]

(iv) Find x when $g^{-1}(x) = -1$ -- [1]

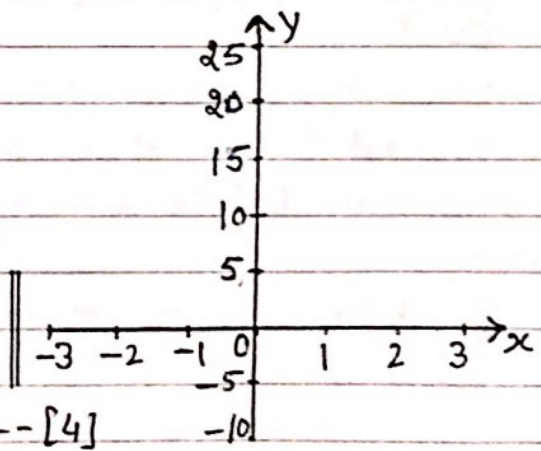
W-16/42/Q9

Q37(a) Complete the table for $y = 3x + \frac{2}{x^2} + 1, x \neq 0$ --- [2]

x	-3	-2	-1	-0.5	-0.3	0.3	0.5	1	2	3
y	-7.8		0	7.5	22.3	24.1		6	7.5	10.2

(b) On the grid, draw the graph of $y = 3x + \frac{2}{x^2} + 1$
for $-3 \leq x \leq -0.3$ and $0.3 \leq x \leq 3$ --- [5]

(c) Write down the value of the largest integer k , so that the equation $3x + \frac{2}{x^2} + 1 = k$ has exactly one solution. --- [1]



d (i) By drawing a suitable straight line on the grid, solve $3x + \frac{2}{x^2} + 1 = 15 - 3x$ --- [4]

(ii) The equation $3x + \frac{2}{x^2} + 1 = 15 - 3x$ can be written in the form $ax^3 + bx^2 + cx + d = 0$, where a, b and c are integers. Find a, b and c . --- [3]

W-16/43/Q2

Q38(a) Solve, $8x - 5 = 22 - 4x$ --- [2]

(b) Solve, $6x \geq 2x + 14$ --- [2]

(c) Factorise, $x^2 - 4x - 21$ -- [2]

(d) Expand the brackets and simplify:
 $(3x - 2y)(4x + 3y)$

W-16/43/Q3 --- [3]

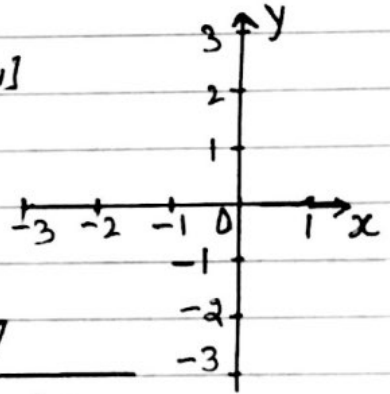
Q39 Solve $\frac{2}{x+3} + \frac{1}{12} = \frac{3}{2x-1}$ --- [7]

W-16/43/Q11

Q40 The table shows some values of $y = x^3 + 3x^2 - 2$.

x	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1
y	-2	1.13		1.38		-1.38		-1.13	

- (a) Complete the table of values. --- [3]
- (b) On the grid, draw the graph of $y = x^3 + 3x^2 - 2$ for $-3 \leq x \leq 1$ --- [4]
- (c) By drawing a suitable line, solve the equation $x^3 + 3x^2 - 2 = \frac{1}{2}(x+1)$ --- [4]
- (d) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where $x = -1.75$. --- [3]



M-15/42/Q3

Q41 (a) Factorise $121y^2 - m^2$ --- [2]

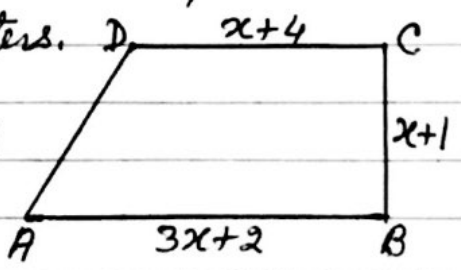
(b) Write as a single fraction in its simplest form.

$\frac{4}{3x-5} + \frac{x+2}{x-1}$ --- [3]

(c) Solve the equation: $3x^2 + 2x - 7 = 0$ show all your working and give your answers correct to 2 decimal places. --- [4]

(d) In this part, all lengths are in centimeters.

ABCD is trapezium with area 15 cm^2



- (i) Show that $2x^2 + 5x - 12 = 0$ --- [3]
- (ii) Solve the equation: $2x^2 + 5x - 12 = 0$ --- [3]
- (iii) Write down length AB. --- [1]

M-15/42/Q4

Q42 The school cook buys potatoes in small sacks, each of mass 4 kg, and large sacks, each of mass 10 kg.

He buys x small sacks and y large sacks.

Today, he buys less than 40 kg of potatoes.

(a) Show that $2x + 5y < 40$. (Continued \rightarrow) --- [1]

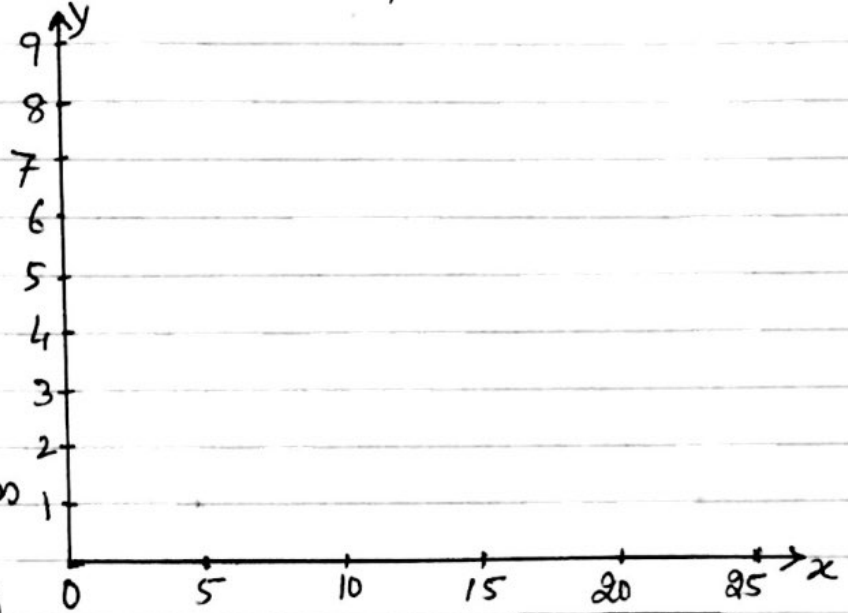
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Q42(b) He buys more large sacks than small sacks.

He buys no more than 6 large sacks.

Write down two inequalities to show this information, --- [2]

(c) On the grid, show the information in part (a) and part (b) by drawing three straight lines and shading the unwanted regions. --- [5].



(d) Find the greatest mass of potatoes the co-op can buy today. --- [2]

M-15/42/Q10

Q43

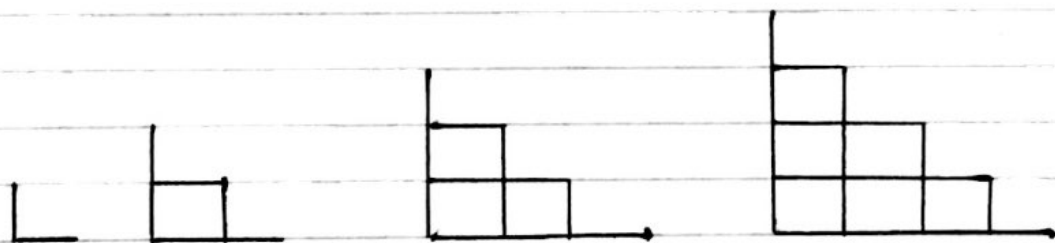


Diagram 1 Diagram 2 Diagram 3 Diagram 4

Diagram 1 shows two lines of length 1 unit at right angles forming an L.

Two Ls are added to diagram 1 to make diagram 2. This forms one small square.

Three Ls are added to diagram 2 to make diagram 3. This forms three small squares.

The sequence of diagrams continues.

(a) Draw diagram 5. --- [1]

(Continued →)

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myCOMPANION

Q43 (b) Complete the table.

--- [2]

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5
Number of lines of length 1 unit	2	6	12	20	
Number of small squares	0	1	3	6	

(c) Find an expression, in terms of n , for the number of lines of length 1 unit in Diagram n . --- [2]

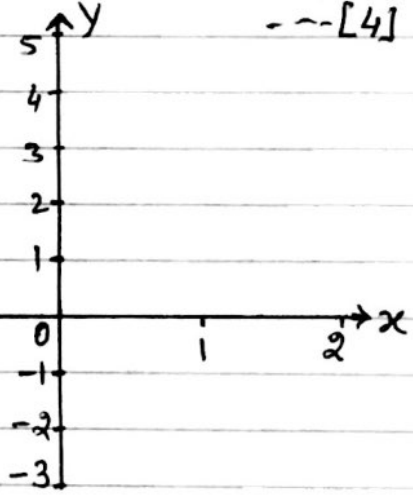
(d) Find an expression, in terms of n , for the number of small squares in Diagram n . M-15/42/Q11 --- [2]

Q44 The table shows some values for $y = x^2 - \frac{1}{2x}$, $x \neq 0$

x	-2	-1.5	-1	-0.5	-0.25	-0.2	0.2	0.25	0.5	1	1.5	2
y	4.25	2.58			2.06	2.54	-2.46	-1.94			1.92	3.75

(a) Complete the table. --- [4]

(b) On the grid, draw the graph of, $y = x^2 - \frac{1}{2x}$ for $-2 \leq x \leq -0.2$ and $0.2 \leq x \leq 2$ --- [5]



(c) By drawing a suitable line, use your graph to solve the equation $x^2 - \frac{1}{2x} = 2$ --- [3]

(d) The equation $x^2 - \frac{1}{2x} = k$ has only one solution.

Write down the range of values of k for which this is possible. -- [2]

(e) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where $x = -1$. S-15/41/Q2 -- [3]

Q45 (a) Jamil, Kiera and Luther collect badges.

Jamil has x badges.

Kiera has 12 badges more than Jamil.

Luther has 3 times as many badges as Kiera.

Altogether they have 123 badges.

Form an equation and solve it to find the value of x . --- [3]

(Continued →)

(continued →)

Q45 (b) Find the integer values of t which satisfy the inequalities.

$$4t + 7 < 39 \leq 7t + 2 \quad \text{--- [3]}$$

(c) Solve the following equations:

$$(i) \frac{21-x}{x+3} = 4 \quad \text{--- [3]}$$

$$(ii) 3x^2 + 7x - 5 = 0 \quad \text{show all your working,}$$

and give your answers correct to 2 decimal places. --- [4]

S-15/41/Q8

$$Q46(a) \text{ Solve. } 11x + 15 = 3x - 7 \quad \text{--- [2]}$$

$$(b)(i) \text{ Factorise. } x^2 + 9x - 22 \quad \text{--- [2]}$$

$$(ii) \text{ Solve. } x^2 + 9x - 22 = 0 \quad \text{--- [1]}$$

$$(c) \text{ Rearrange. } y = \frac{2(x-a)}{x} \text{ to make } x \text{ the subject. } \text{--- [4]}$$

$$(d) \text{ Simplify } \frac{x^2 - 6x}{x^2 - 36} \quad \text{--- [3]}$$

W-17/41/Q3Q47 (a) The cost of one apple is a cents. The cost of 1 pear is p cents.

The total cost of 7 apples and 9 pears is 354 cents.

(i) Write down an equation in terms of a and p . --- [1]

(ii) The cost of 1 pear is 2 cents more than the cost of 1 apple.

Find the value of a and the value of p . --- [3](b) Rowena walks 2 km at an average speed of x km/h.(i) Write an expression, in terms of x , for the time taken. --- [1](ii) Rowena then walks 3 km at an average speed of $(x-1)$ km/h.

The total time to walk 5 km is 2 hours.

(a) Show that $2x^2 - 7x + 2 = 0$ --- [3](b) Find the value of x . Show all your working and give your answer correct to 2 decimal places. --- [4]W-17/42/Q8

Q48 (a) Solve, $\frac{x}{7} = 49$ --- [1]

(b) Simplify, (i) x^0 --- [1]

(ii) $x^7 \times x^3$ --- [1]

(iii) $\frac{(3x^6)^2}{x^{-4}}$ --- [2]

(c) (i) Factorise completely, $2x^2 - 18$ --- [2]

(ii) Simplify, $\frac{2x^2 - 18}{x^2 + 7x - 30}$ --- [3]

W-17/43/Q2

Q49 Luigi and Alfredo run in a 10 km race. Luigi average speed was x km/h. Alfredo average speed was 0.5 km/h slower than Luigi's average speed.

(a) Luigi took $10/x$ hours to run the race. Write down an expression, in terms of x , for the time that Alfredo took to run the race. --- [1]

(b) Alfredo took 0.25 hours longer than Luigi to run the race.

(i) Show that $2x^2 - x - 40 = 0$ --- [4]

(ii) Use quadratic formula to solve $2x^2 - x - 40 = 0$, show all your working and show your answers correct to 2 decimal places. --- [4]

(iii) Work out the time that Luigi took to run 10 km race. Give your answer in hours and minutes, correct to the nearest minute. --- [3]

W-17/43/Q9

Q50 On the first part of a journey, Alan drove a distance of x km and his car used 6 litres of fuel. The rate of fuel used by his car was $\frac{600}{x}$ litres per 100 km.

(a) Alan then drove another $(x+20)$ km and his car used another 6 litres of fuel.

(i) Write down an expression, in terms of x , for the rate of fuel used by his car on this part of the journey. Give your answer in litres per 100 km. --- [1]

(ii) On this part of the journey the rate of fuel used by the car decreased by 1.5 litres per 100 km. Show that $x^2 + 20x - 8000 = 0$ --- [4]

(Continued →)

(Continued →)

Q50(b) Solve the equation $x^2 + 20x - 8000 = 0$ --- [3]

(c) Find the rate of fuel used by Alan's car for the complete journey. Give your answer in litres per 100 km. --- [2]

S-15/42/Q3

Q51 (a) Expand and simplify. $3x(x-2) - 2x(3x-5)$ --- [3]

(b) Factorise the following completely. (i) $6W + 3Wy - 4x - 2xy$ --- [2]

(ii) $4x^2 - 25y^2$ --- [2]

(c) Simplify: $\left(\frac{16}{9x^4}\right)^{-3/2}$ --- [2]

(d) n is an integer.

(i) Explain why $2n-1$ is an odd number. --- [1]

(ii) Write down, in terms of n , the next odd number after $2n-1$ --- [1]

(iii) Show that the difference between the squares of two consecutive odd numbers is a multiple of 8. --- [3]

S-15/42/Q9

Q52 (a) Calculate $2^{0.7}$ --- [1]

(b) Find the value of x in each of the following.

(i) $2^x = 128$ --- [1]

(ii) $2^x \times 2^9 = 2^{13}$ --- [1]

(iii) $2^9 \div 2^x = 4$ --- [1]

(iv) $2^x = \sqrt[3]{2}$ --- [1]

(c) (i) Complete this table of values for $y = 2^x$ --- [2]

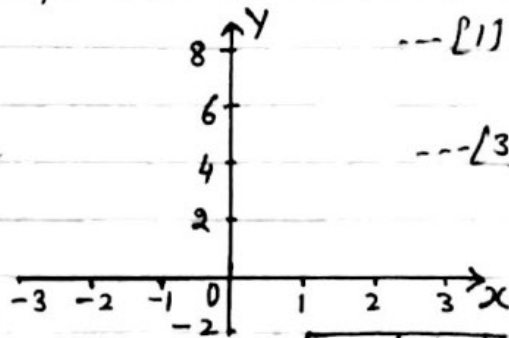
x	-3	-2	-1	0	1	2	3
y	0.125		0.5		2	4	8

(ii) on the grid, draw the graph of $y = 2^x$ for $-3 \leq x \leq 3$ --- [4]

(iii) Use your graph to solve $2^x = 5$. --- [1]

(iv) Find the equation of the line joining the points $(1, 2)$ and $(3, 8)$. --- [3]

(v) By drawing a suitable line on your graph solve $2^x - 2 - x = 0$ --- [2]



W-15/41/Q9

Q53(a) Factorise $x^2 - 3x - 10$ ---[2]

(b) (i) Show that $\frac{x+2}{x+1} + \frac{3}{x} = 3$ simplifies to $2x^2 - 2x - 3 = 0$ ---[3]

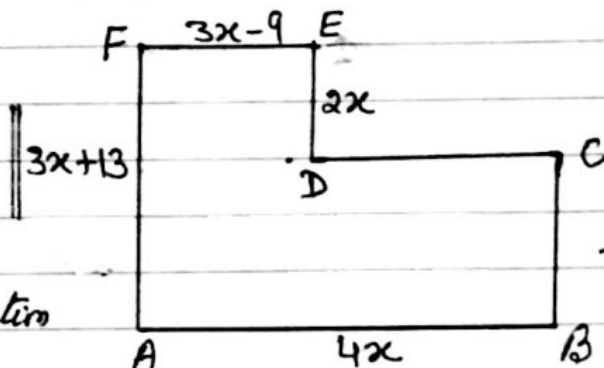
(ii) Solve: $2x^2 - 2x - 3 = 0$ Give your answers correct to 3 decimal places. Show all your working. ---[4]

(c) Simplify $\frac{2x+3}{x+2} - \frac{x}{x+1}$ ---[4]

W-15/41/Q8

Q54(a) The area of shape ABCDEF is $24a^2$.

All lengths are in centimetres.



(i) Show that $5x^2 + 17x - 12 = 0$ ---[3]

(ii) Solve, by factorising, the equation $5x^2 + 17x - 12 = 0$,

you must show all your working. ---[3]

(b) Solve the simultaneous equations.

$$3x - 2y = 23$$

you must show all your working.

$$-4x - y = -5$$

---[3]

(c) Solve the equation.

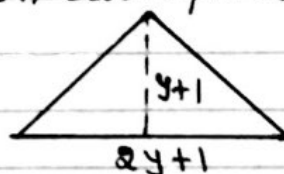
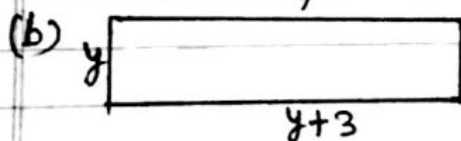
$$\frac{2(t+3)}{t} - \frac{t}{t+3} = 1$$

---[5]

W-15/42/Q5

Q55(a) The cost of a loaf of bread is x cents. The cost of a cake is $(x-5)$ cents.

The total cost of 6 loaves of bread and 11 cakes is \$13.56. Find x . ---[4]



The area of the rectangle and the area of the triangle are equal. Find the value of y . ---[4]

(c) The cost of a bottle of water is $(w-1)$ cents. The cost of a bottle of milk is $(2w-11)$ cents. A certain number of bottles of water costs \$4.80.

The same number of bottles of milk costs \$7.80.

Find the value of w . ---[4]

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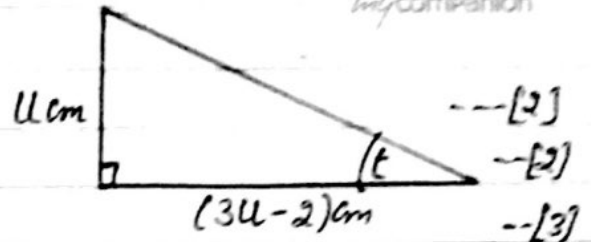
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Q55(d) The area of triangle is 2.5 cm^2

(i) Show that $3u^2 - 2u - 5 = 0$

(ii) Factorise $3u^2 - 2u - 5$

(iii) Find the size of angle t .



W-15/43/Q7

Q56 The distance a train travels a journey is 600 km.

(a) Write down an expression, in terms of x , for the average speed of the train when (i) the journey takes x hours. --- [1]

(ii) the journey takes $(x+1)$ hours. --- [1]

(b) The difference between the average speeds in part (a)(i) and part (a)(ii) is 20 km/h.

(i) Show that $x^2 + x - 30 = 0$ --- [3]

(ii) Find the average speed of the train for the journey in part (a)(ii). Show all your working. --- [4]

S-14/42/Q8

Q57 (a)(i) Show that the equation $\frac{7}{x+4} + \frac{2x-3}{2} = 1$

can be simplified to $2x^2 + 3x - 6 = 0$ --- [3]

(ii) Solve the equation $2x^2 + 3x - 6 = 0$ show all your working and give your answers correct to 2 decimal places. --- [4]

S-14/43/Q8(a)

Q58 (a) Rearrange the formula $v^2 = u^2 - 2as$ to make u the subject. --- [2]

(b) Chuck cycles along Skyline Drive. He cycles 60 km at an average speed of x km/h. He then cycles a further 45 km at an average speed of $(x+4)$ km/h. His total journey time is 6 hours. --- [4]

(i) Write down an equation in x and show that it simplifies to $2x^2 - 27x - 80 = 0$

(ii) solve $2x^2 - 27x - 80 = 0$ to find the value of x . --- [3]

W-14/41/Q2(a),(b)

Q59 (a) Expand and simplify. (i) $4(2x-1) - 3(3x-5)$ --- [2]

(ii) $(2x-3y)(3x+4y)$ --- [3]

(b) Factorize. $x^3 - 5x$ --- [1]

(c) Solve the inequality. $\frac{2x+1}{3} \leq \frac{5x-8}{4}$ --- [3]

(Continued →)

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Q59(d)(i) $x^2 - 9x + 12 = (x-p)^2 - q$

Find the value of p and the value of q . ---[3]

(ii) Write down the minimum value of $x^2 - 9x + 12$ ---[1]

(iii) Write down the equation of the line of symmetry of the graph of $y = x^2 - 9x + 12$. ---[1]

W-14/41/Q4

Q60(a) Solve the inequality. $7x - 5 > 3(2 - 5x)$ ---[3]

(b)(i) Factorise completely. $9x^2 - 29x - 8 + 4p$ ---[2]

(ii) Factorise. $9p^2 - 25$ ---[1]

(c) Solve the equation by factorising. $5x^2 + x - 18 = 0$ ---[3]

W-14/42/Q2

Q61 (a) Simplify. (i) $x^3 \div \frac{3}{x^5}$ ---[1]

(ii) $5xy^8 \times 3x^6y^{-5}$ ---[2]

(iii) $(64x^{12})^{2/3}$ ---[2]

(b) Solve. $3x^2 - 7x - 12 = 0$, show your working and give your answers correct to 2 decimal places. ---[4]

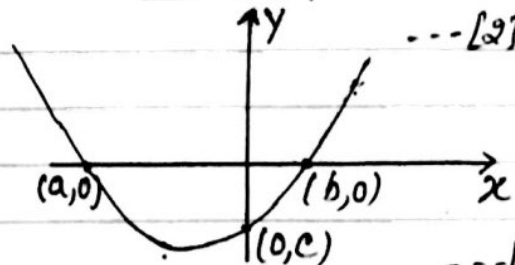
(c) Simplify. $\frac{x^2 - 25}{x^3 - 5x^2}$ ---[3]

W-14/43/Q6

Q62 (b)(i) Factorise $x^2 + 3x - 10$ ---[2]

(ii) The graph of $y = x^2 + 3x - 10$ is sketched.

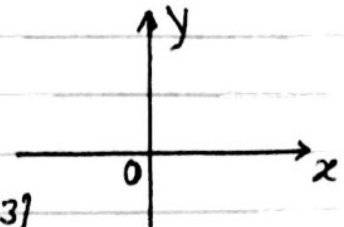
Write down the values of a , b and c .



(iii) Write down the equation of the line of symmetry of the graph of $y = x^2 + 3x - 10$ ---[3]

(c) Sketch the graph of $y = 18 + 7x - x^2$ on the axes below. ---[1]

Indicate clearly the values where the graph crosses the x and y axes.

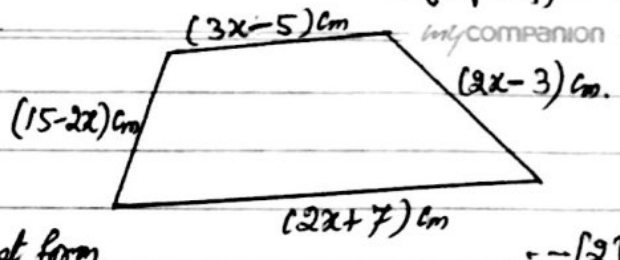


(d) (i) $x^2 + 12x - 7 = (x+p)^2 - q$
Find the values of p and the values of q . ---[3]

(ii) Write down the minimum value of y for the graph of $y = x^2 + 12x - 7$ ---[1]

W-14/43/Q8

Q63 (a) (i) Write an expression, in terms of x , for the perimeter of the quadrilateral.

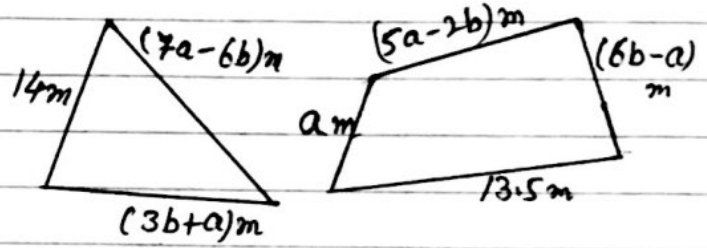


Give your answer in its simplest form. --- [2]

(ii) The perimeter of the quadrilateral is 32 cm.

Find the length of the longest side of the quadrilateral. --- [3]

(b) The triangle has a perimeter of 32.5 m. The quadrilateral has a perimeter of 39.75 m.



Write two equations in terms of a and b and simplify them. Use an algebraic method to find the values of a and b . Show all your working. --- [6]

W-14/43/Q10

Q64 Paul buys a number of large sacks of fertiliser costing \$ x each. He spends \$27.

(a) Write down, in terms of x , an expression for the number of large sacks which Paul buys. --- [1]

(b) Rula buys a number of small sacks of fertiliser. Each small sack costs \$2 less than a large sack. Rula spends \$25. Write down, in terms of x , an expression for the number of small sacks which Rula buys. --- [1]

(c) Rula buys 4 more sacks than Paul. Write down an equation in x and show that it simplifies to $2x^2 - 3x - 27 = 0$. --- [4]

(d) Solve $2x^2 - 3x - 27 = 0$. --- [3]

(e) Calculate the number of sacks which Paul buys. --- [1]

S-13/42/Q5

Q65 (a) Write as a single fraction. (i) $\frac{5}{4} - \frac{2x}{5}$ --- [2]

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

(b) Solve the simultaneous equations: $9x - 2y = 12$ --- [3]

(c) Simplify. $\frac{7x+21}{2x^2+9x+9}$ $3x+4y = -10$ --- [4]

S-13/42/Q10

Q66(a) (i) Solve $2(3x-7)=13$ --- [3]

(ii) Solve by factorising $x^2-7x+6=0$ --- [3]

(iii) Solve $\frac{3x-2}{5} + \frac{x+2}{10} = 4$ --- [4]

S-13/43/Q10(a)

Q67 (a) Solve the equation $8x^2-11x-11=0$, show all your working and give your answers correct to 2 decimal places. --- [4]

(b) y varies directly as the square root of x .
 $y=18$ when $x=9$; find y when $x=484$. --- [3]

(c) Sara spends $\$x$ on pens, which cost $\$2.50$ each. She also spends $\$(x-14.50)$ on pencils which cost $\$0.50$ each. The total number of pens and the number of pencils is 19.

Write down and solve an equation in x . --- [6]

Q68

(a) Write a single fraction in its simplest form. $\frac{2x-1}{2} - \frac{3x+1}{5}$ --- [3]

(b) Expand and simplify: $(2x-3)^2 - 3x(x-4)$ --- [4]

(c) (i) Factorise, $2x^2+5x-3$ --- [2]

(ii) Simplify: $\frac{2x^2+5x-3}{2x^2-18}$ --- [3]

W-13/42/Q3

Q69 (a) Rearrange $s = ut + \frac{1}{2}at^2$ to make a the subject. --- [3]

(b) The formula $v = u + at$ can be used to calculate the speed, v , of a car. $u=15$, $a=2$ and $t=8$, each correct to nearest integer. Calculate the upper bound of the speed. --- [3]

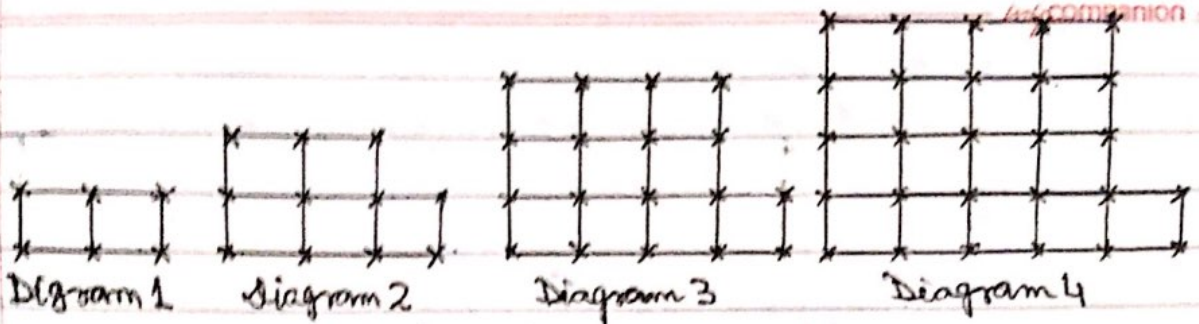
W-13/43/Q8(a)(b)

Q70 (a) Simplify $\frac{x^2-3x}{x^2-9}$ --- [3]

(b) Solve $\frac{15}{x} - \frac{20}{2x+1} = 2$ --- [7]

W-13/43/Q10

Q 71.



These are the first four diagrams in a sequence.
Each diagram is made from small squares and crosses.

(a) Complete the table: --- [6]

Diagram	1	2	3	4	5	n
Number of crosses	6	10	14	-	-	-
Number of small squares	2	5	10	-	-	-

(b) Find the number of crosses in Diagram 60. --- [1]

(c) Which diagram has 226 squares? --- [1]

(d) The side of each small square has length 1cm.

The number of lines of length 1cm in Diagram n is $2n^2 + 2n + 9$
Find the value of n . --- [2]

[W-17/41/Q6]

Q 72. The first four terms of sequences A, B, C and D are shown in the table:

Sequence	1st term	2nd term	3rd term	4th term	5th term	n th term
A	$\frac{1}{3}$	$\frac{2}{4}$	$\frac{3}{5}$	$\frac{4}{6}$		
B	3	4	5	6		
C	-1	0	1	2		
D	-3	0	5	12		

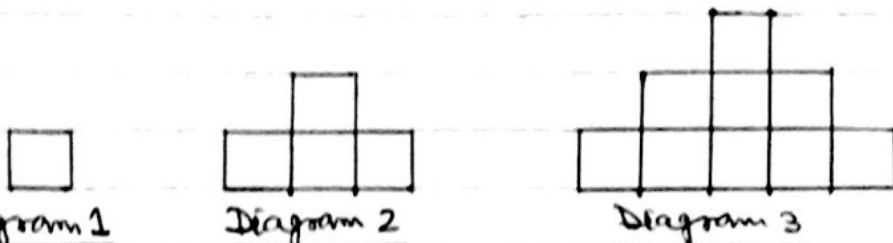
(a) Complete the table. --- [8]

(b) Which term in the sequence A is equal to $\frac{36}{37}$? --- [2]

(c) Which term in sequence D is equal to 725? --- [2]

[S-15/43/Q11]

Q.73. The first three diagrams in a sequence are shown below.
The diagrams are made by drawing lines of length 1cm.



(a) The area of each of the first three diagrams are shown in this table:

Diagram	1	2	3
Area (cm ²)	1	4	9

(i) Find the area of Diagram 4. --- [1]

(ii) Find, in terms of n , the area of Diagram n , --- [1]

(b) The number of 1cm lines needed to draw each of the first three diagrams are shown in the table.

Diagram	1	2	3
Number of 1cm lines	4	13	26

(i) Find the number of 1cm lines needed to draw Diagram 4. -- [1]

(ii) In which diagram are 118 lines of length 1cm needed. -- [1]

(c) The total number of 1cm lines needed to draw both Diagram 1 and Diagram 2 is 17. The total number of 1cm lines needed to draw all the first n diagrams is,

$$\frac{2}{3}n^3 + an^2 + bn$$

Find the value of a and the value of b . Show all your working. --- [6]

[W-15/41/29]

Q.74. The table shows the first five terms of sequence A, B and C.

Sequence	1st term	2nd term	3rd term	4th term	5th term	6th term
A	3	4	5	6	7	
B	0	1	4	9	16	
C	-3	-3	-1	3	9	

(a) Complete the table for 6th term of each sequence. --- [2]

(b) Write down the n th term of sequence A. --- [1]

(c) (i) Find the n th term of sequence B. --- [2]

(ii) Find the value of n when the n th term of sequence B is 8281. --- [2]

d (i) Find the n th term of sequence C in its simplest form. --- [2]

(ii) Find the 8th term of sequence C.

(Continued) --- [1]

(Continued →)

Q.74 (e) The n th term of another sequence D is $(-\frac{1}{2})^{n-1}$

Complete the table for the first four terms of sequence D. --- [3]

Sequence	1st term	2nd term	3rd term	4th term
D				

W-15/42/Q10

Q.75 Complete the table for each sequence. --- [11]

Sequence	1st term	2nd term	3rd term	4th term	5th term	6th term	n th term
A	15	8	1	-6			
B	$\frac{5}{18}$	$\frac{6}{19}$	$\frac{7}{20}$	$\frac{8}{21}$			
C	2	5	10	17			
D	2	6	18	54			

W-15/43/Q10

Q.76

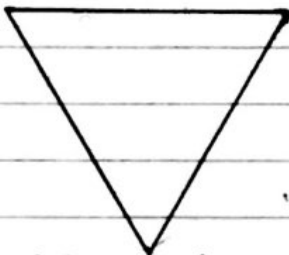


Diagram 1

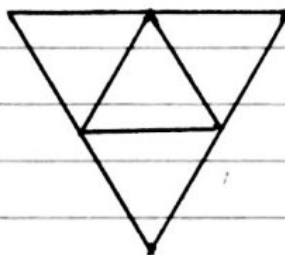


Diagram 2

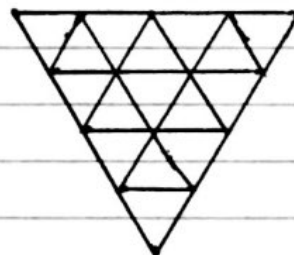


Diagram 3

The first three diagrams in a sequence are shown above.

Diagram 1 shows an equilateral triangle with sides of length 1 unit.

In Diagram 2, there are 4 triangles with sides of length $\frac{1}{2}$ unit.

In Diagram 3, there are 16 triangles with sides of length $\frac{1}{4}$ unit.

(a) Complete this table for diagrams 4, 5, 6 and n . --- [6]

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6	Diagram n
length of side	1	$\frac{1}{2}$	$\frac{1}{4}$				
length of side as a power of 2	2^0	2^{-1}	2^{-2}				

(b) (i) Complete this table for the number of the smallest triangles in Diagram 4, 5 and 6. --- [2]

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6
Number of smallest triangles	1	4	16			
Number of smallest triangles as power of 2	2^0	2^2	2^4			

(Continued →)

(Continued →)

Q 76 (b) (ii) Find the number of smallest triangles in Diagram n , giving your answer as a power of 2. --- [1]

(c) Calculate the number of smallest triangles in the diagram where the smallest triangles have sides of length $\frac{1}{128}$ units. --- [2]

S-16/43/R11

Q 77



The first four diagrams in a sequence are shown above. The diagrams are shown using white squares \square and grey squares \blacksquare .

(a) Complete the columns in the table for Diagram 4 and Diagram n .

Diagram	1	2	3	4	n
Number of White Squares	12	20	28		
Number of Grey Squares	0	1	4		
Total Number of Squares	12	21	32		$(n+1)(n+5)$

(b) Work out the number of Diagram which has a total of 480 squares. --- [2]

(c) The total number of squares in the first n diagrams is $\frac{1}{3}n^3 + pn^2 + qn$

(i) Use $n=1$ in the expression to show that $p+q = 11\frac{2}{3}$ --- [1]

(ii) Use $n=2$ in the expression to show that $4p+2q = 30\frac{1}{3}$ --- [2]

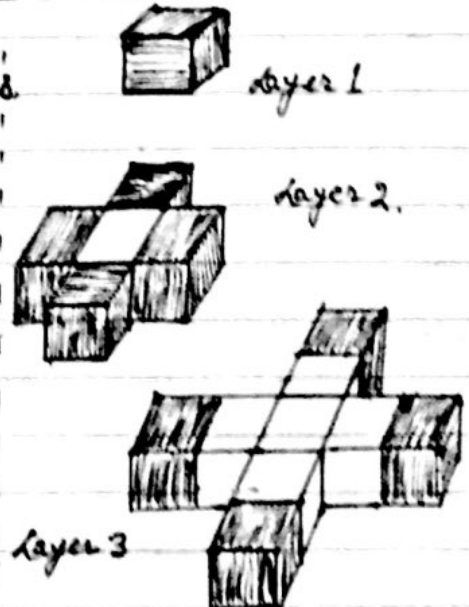
(iii) find the value of p and q . --- [3]

N-14/41/R9

Q 78 Diagrams show layers of white and grey cubes. Khadega places these layers on the top of each other to make a tower.

(a) Complete the table for towers with 5 and 6 layers.

Number of layers	1	2	3	4	5	6
Total Number of White Cubes	0	1	6	15		
Total Number of Grey Cubes	1	5	9	13		
Total number of cubes	1	6	15	28		



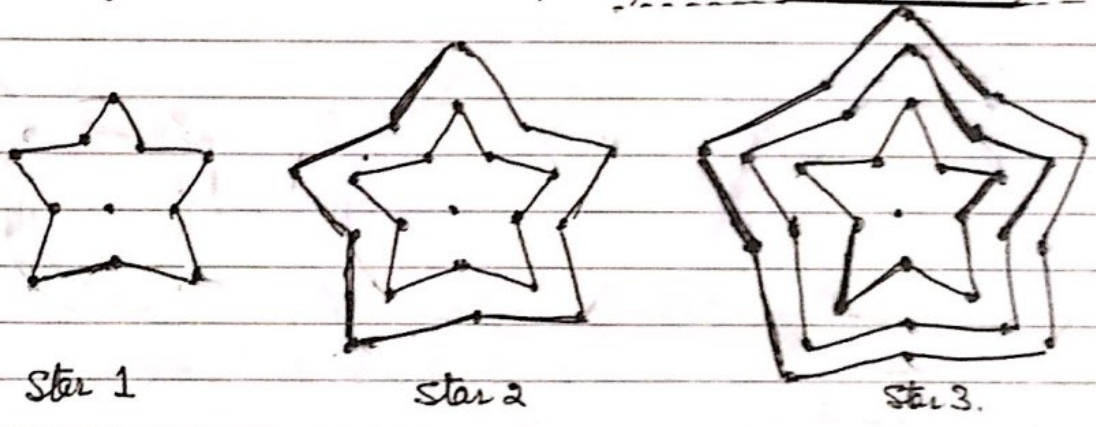
--- [4]

(Continued →)

(→Continued) Sequences

- Q 78 (b) (i) Find in terms of n , the total number of grey cubes in a tower with n layers, --[2]
- (ii) Find the total number of grey cubes in a tower with 60 layers, --[1]
- (iii) Khadega has plenty of white cubes but only 200 grey cubes. How many layers are there in the highest tower that she can build, --[2]
- (c) The expression for the total number of white cubes in a tower with n layers is $pn^2 + qn + 3$. Find the value of p and the value of q . Show all your working, ---[5]
- (d) Find an expression, in terms of n , for the total number of cubes in a tower with n layers. Give your answer in its simplest form. 4-14/42/29 --[2]

Q.79



The diagrams show a sequence of stars made of lines and dots.

(a) Complete the table for star 5, star 7 and star n . ---[4]

	Star 1	Star 2	Star 3	Star 4	Star 5	Star 7	Star n
Number of lines	10	20	30	40			
Number of dots	11	21	31	41			

(b) The sums of the number of dots in two consecutive stars are shown in table.

Star 1 and Star 2	Star 2 and Star 3	Star 3 and Star 4
32	52	72

Find the sum of numbers of dots in.

- (i) Star 10 and Star 11 ---[1]
- (ii) Star n and Star $(n+1)$ ---[1]
- (iii) Star $(n+7)$ and Star $(n+8)$ ---[1]

(continued →)

(→ Continued)

Sequences

COMPANION

Q 79 (C) The total number of dots in the first n stars is given by the expression $5n^2 + 6n$.

(i) Show that this expression is correct when $n=3$ --- [2]

(ii) Find the total number of dots in the first 10 stars. --- [1]

(d) The total number of dots in the first n stars is $5n^2 + 6n$.

The total number of dots in the $(n+1)$ th star is $10(n+1)$

add those two expressions to show that the total number of dots in the first $(n+1)$ stars is $5(n+1)^2 + 6(n+1)$

you must show each of your steps of working

--- [4]
5-13/41/2/10

Q 80

$$1^2 = 1$$

$$1^2 + 2^2 = 5$$

$$1^2 + 2^2 + 3^2 = 14$$

$$1^2 + 2^2 + 3^2 + 4^2 = 30$$

$$1^2 + 2^2 + 3^2 + 4^2 + \dots + n^2 = an^3 + bn^2 + \frac{n}{6}$$

Work out the values of a and b .

--- [6]
5-13/43/2/10(b)

Q 81 (a)

$$1 = 1$$

$$1 + 2 = 3$$

$$1 + 2 + 3 = 6$$

$$1 + 2 + 3 + 4 = 10$$

(i) Write down the next line of this pattern. --- [1]

(ii) The sum of first n integers is $\frac{n}{k}(n+1)$

Show that $k=2$.

--- [2]

(iii) Find the sum of the first 60 integers.

--- [1]

(iv) Find n , when the sum of first n integers is 465. --- [2]

$$(v) 1 + 2 + 3 + 4 + \dots + x = \frac{(n-8)(n-7)}{2}$$

Write x in terms of n .

--- [1]

(Continued →)

(→ Continued)

Q 81(b)

$$1^3 = 1$$

$$1^3 + 2^3 = 9$$

$$1^3 + 2^3 + 3^3 = 36$$

$$1^3 + 2^3 + 3^3 + 4^3 = 100$$

(i) Complete the statement.

$$1^3 + 2^3 + 3^3 + 4^3 + 5^3 = \dots = (\dots)^2 \quad \dots [2]$$

(ii) The sum of the first n integers is $\frac{n}{2}(n+1)$.

Find an expression, in terms of n , for the sum of the first n cubes. $\dots [1]$

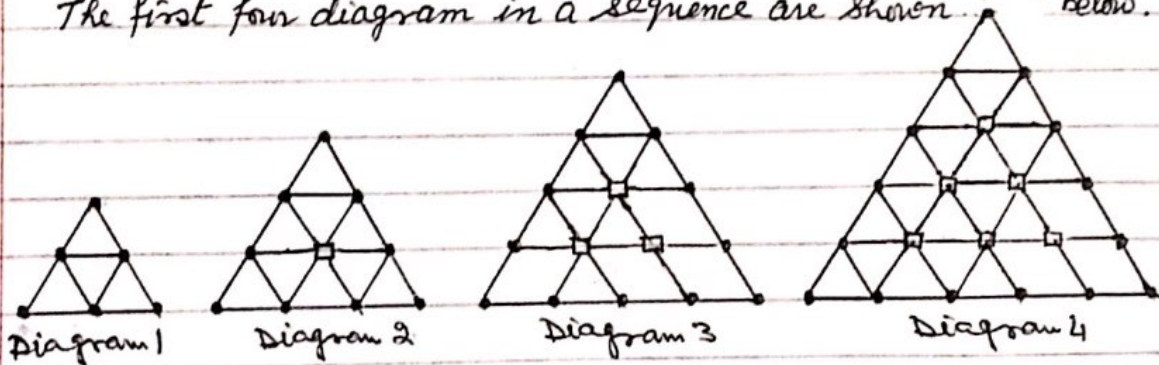
(iii) Find the sum of first 19 cubes. W-13/41/Q10 $\dots [2]$

Q 82 Complete the table for the following sequences. The first has been completed for you.

	Sequence				Next two terms		n th term	
	1	5	9	13	17	21	$4n-3$	
(a)	12	21	30	39				$\dots [3]$
(b)	80	74	68	62				$\dots [3]$
(c)	1	8	27	64				$\dots [2]$
(d)	2	10	30	68				$\dots [2]$

W-13/42/Q10

Q 83 The first four diagrams in a sequence are shown below.



The diagrams are made from dots (•) and squares (◻) joined by lines. (a) Complete the table: $\dots [9]$

Diagram	1	2	3	4	5	n
Number of dots	6	9	12			
Number of squares	0	1	3			$\frac{1}{2}n(n-1)$
Number of triangles	4	9	16			
Number of lines	9	18	30	45	63	$\frac{3}{2}(n+1)(n+2)$

(b) Which diagram has 360 lines, $\dots [2]$ (Continued →)

(→ Continued)

Q 83 (c) The total number of lines in the first n diagrams is.

$$\frac{1}{2}n^3 + pn^2 + qn$$

(i) When $n=1$, show that $p+q = 8\frac{1}{2}$ --- [1]

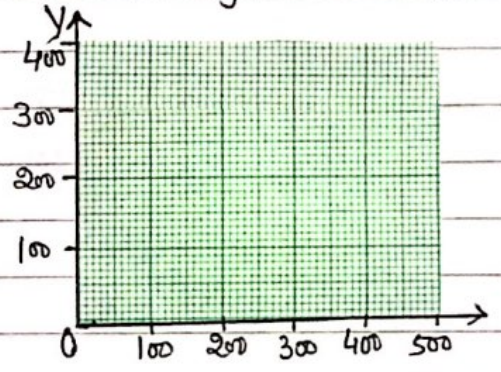
(ii) By choosing another value of n and using equation in part (c)(i), find the values of p and q . [5]

W-13	23	09
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Q.84 Sima sells x biscuits and y cakes.

- (a) (i) She sells at least 100 biscuits. Write down an inequality in x , --- [1]
- (ii) She sells at least 120 cakes. Write down an inequality in y . --- [1]
- (iii) She sells a maximum of 300 biscuits and cakes altogether, write down an inequality in x and y . --- [1]
- (iv) Sima makes a profit of 40^{cents} on each biscuit and 80 cents on each cake. Her total profit is at least \$160. Show that $x + 2y \geq 400$ --- [1]

(b) On the grid, draw four lines to show the four inequalities and shade the unwanted regions. --- [6]



(c) Calculate Sima's maximum profit. Give your answer in dollars. --- [2]

S-15/42/Q8

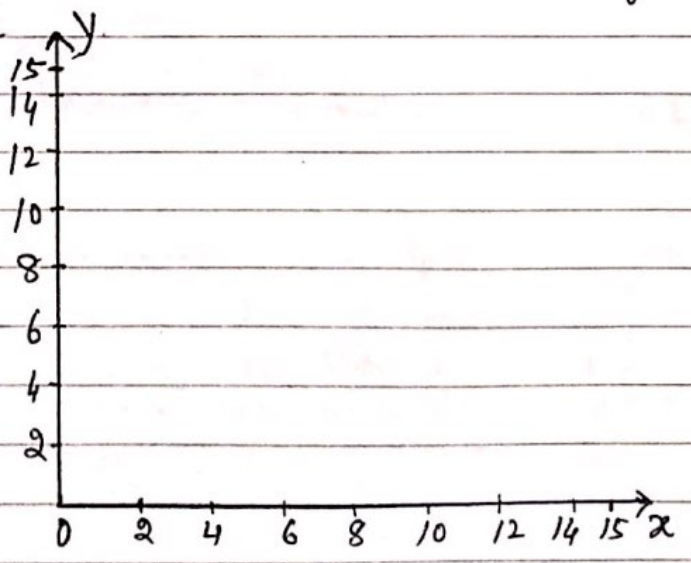
Q.85 Ali buys x rose bushes and y lavender bushes.

- He buys:
- at least 5 rose bushes
 - at most 8 lavender bushes
 - at most 15 bushes in total
 - more lavender bushes than rose bushes.

(a)(i) Write down four inequalities, in terms of x and/or y , to show this information. --- [4]

(ii) On the grid, show the information in part (a)(i) by drawing four lines. Label the region R where all four inequalities are true. --- [5]

(b) Rose bushes cost \$6 each and lavender bushes cost \$4.50 each. What is the greatest amount of money Ali could spend? --- [2]



W-15/41/Q4

Q.86 (a) Luka wants to buy x goats and y sheep.

(i) He wants to buy at least 5 goats.

Write down an inequality in x to represent this condition. --- [1]

(ii) He wants to buy at least 11 sheep.

Write down an equality in y to represent this condition. -- [1]

(iii) He wants to buy at least 20 animals.

Write down an inequality in x and y to represent this condition... [1]

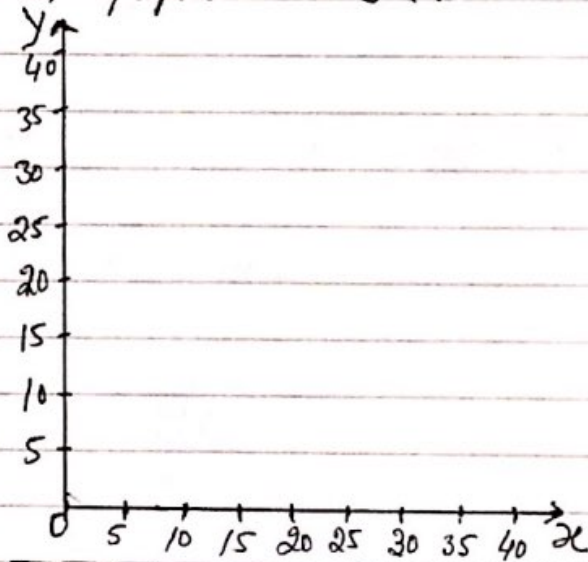
(b) Goats cost \$4 and sheep cost \$8.

The maximum Luka can spend is \$160. Write down an inequality in x and y and show that it simplifies to $x + 2y \leq 40$ -- [1]

(c) (i) On the grid, draw four lines to show the four inequalities and shade the unwanted regions. --- [7]

(ii) Work out the maximum number of animals that Luka can buy. --- [2]

S-13/43/Q3



Q87 (a) Find the equations of the lines L_1 , L_2 and L_3 .

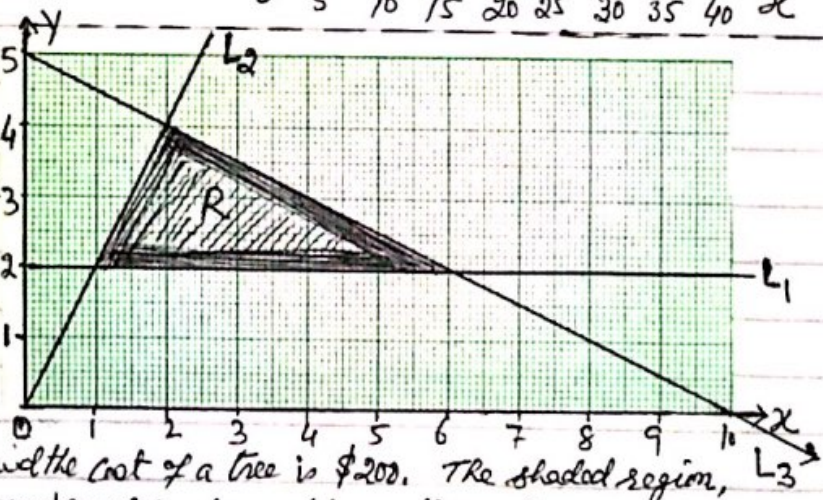
(b) Write down the three inequalities that define the shaded region, R . --- [3]

(c) A gardener buys x bushes and y trees.

The cost of a bush is \$30 and the cost of a tree is \$200. The shaded region, R , shows the only possible number of bushes and trees the gardener can buy.

(i) Find the number of bushes and the number of trees when the total cost is \$720. -- [2]

(ii) Find the number of bushes and the number of trees which give the greatest possible cost. Write down this greatest possible cost. --- [3]



W-13/41/Q9

Q 88 $f(x) = x^3 - 4x^2 + 15$

(a) Complete the table of values for $y = f(x)$ --- [2]

x	-2	-1	-0.5	0	1	2	2.5	3	3.5	4	4.5
y	-9		13.9	15	12		5.6	6	8.9	15	25.1

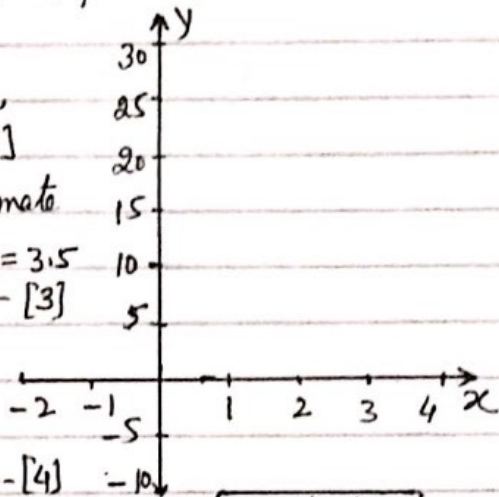
(b) On the grid draw the graph of $y = f(x)$ for $-2 \leq x \leq 4.5$ --- [4]

(c) Use your graph to solve the equation,
 $f(x) = 0$ --- [1]

(d) By drawing a suitable tangent, estimate the gradient of the graph of $y = f(x)$ when $x = 3.5$ --- [3]

(e) By drawing a suitable straight line on the grid, solve the equation,

$x^3 - 4x^2 - 2 + 5 = 0$ --- [4]



W-17/41/Q4

Q. 89. $f(x) = 3 - 2x$ $g(x) = \frac{4}{x}, x \neq 0$ $h(x) = 4^x$

(a) Find $f(5)$ --- [1]

(b) Find $gh(3)$ --- [2]

(c) Find $f^{-1}(x)$ --- [2]

(d) Show that, $hf(x) = \frac{64}{16x}$ --- [3]

(e) Find the value of x when $h(x) = g(0.5)$ --- [2]

W-17/41/Q7

Q. 90

$y = \frac{x^3}{8} - \frac{2}{x^2}, x \neq 0$

(a) Complete the table values. --- [2]

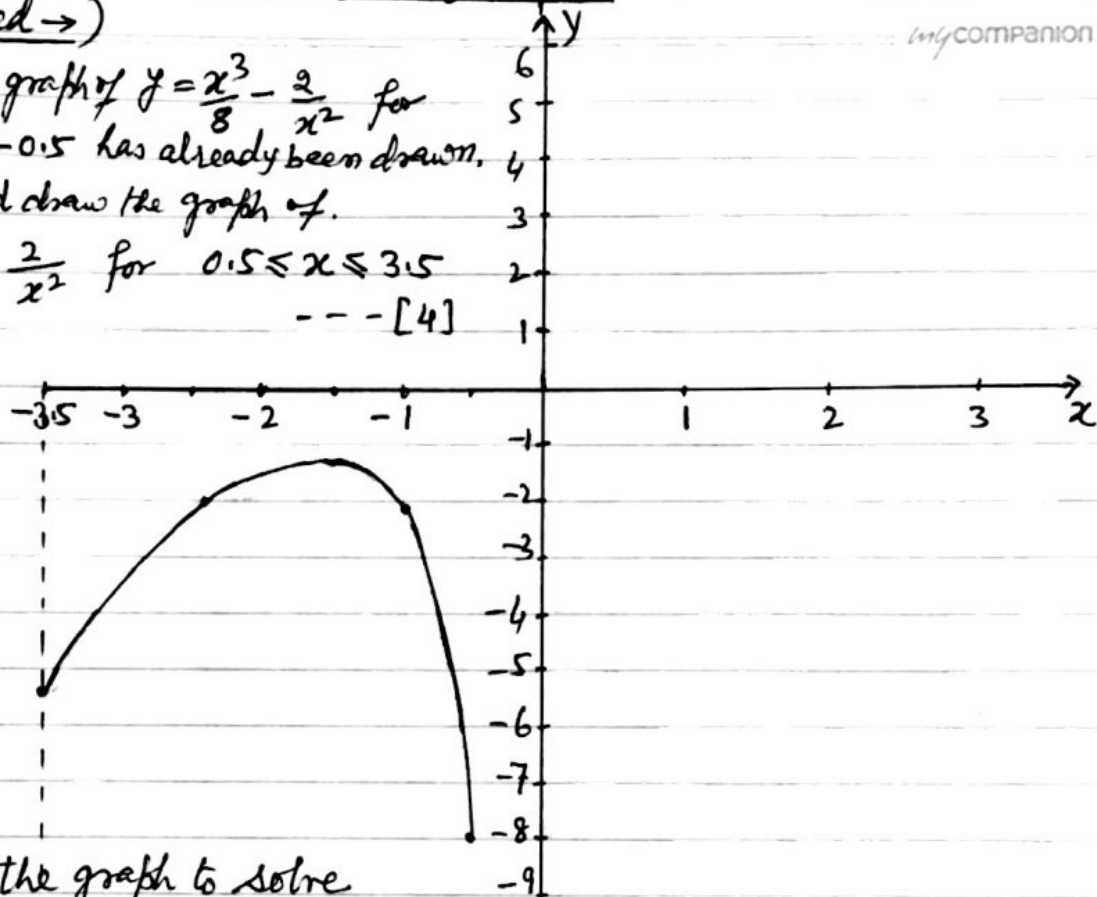
x	0.5	1	1.5	2	2.5	3	3.5
y	-8.0	-1.9	-0.5	0.5	1.6		

(Continued →)

(Continued →)

Q90(b) The graph of $y = \frac{x^3}{8} - \frac{2}{x^2}$ for $-3.5 \leq x \leq -0.5$ has already been drawn. On the grid draw the graph of.

$y = \frac{x^3}{8} - \frac{2}{x^2}$ for $0.5 \leq x \leq 3.5$
--- [4]



(c) Use the graph to solve the equation. $\frac{x^3}{8} - \frac{2}{x^2} = 0$ --- [1]

(d) $\frac{x^3}{8} - \frac{2}{x^2} = k$ and k is an integer.

Write down a value of k when the equation $\frac{x^3}{8} - \frac{2}{x^2} = k$ has

(i) one answer --- [1]

(ii) three answers. --- [1]

(e) By drawing a suitable tangent, estimate the gradient of the curve where $x = -3$. --- [3]

(f)(i) By drawing a suitable line on the grid, find x when $\frac{x^3}{8} - \frac{2}{x^2} = 6 - x$ --- [3]

(ii) the equation $\frac{x^3}{8} - \frac{2}{x^2} = 6 - x$ can be written as, $ax^5 + bx^3 + cx^2 + d = 0$ Find the values of a, b and c . --- [4]

W-17/42/Q5

- Q 91 $f(x) = 1 - 2x$ $g(x) = x + 4$ $h(x) = x^2 + 1$
- (a) Find $f(-1)$ --- [1]
 - (b) Solve the equation $2f(x) = g(x)$ --- [2]
 - (c) Find $fg(x)$, give your answer in its simplest form. --- [2]
 - (d) Find $hh(2)$ --- [2]
 - (e) Find $f^{-1}(x)$ --- [2]
 - (f) $hgf(x) = x^2 + px + q$, find the value of p and the value of q . --- [4]

W-17/42/29

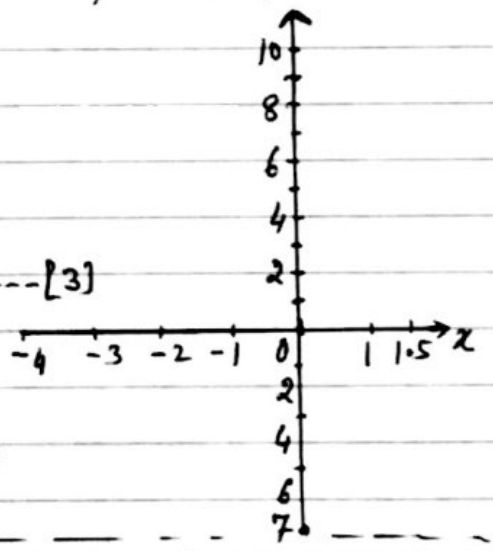
Q 92 The table shows some values of $y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1.5$

x	-4	-3	-2	-1	0	1	1.5
y		0	-5		-3	4	

- (a) Complete the table. --- [3]
- (b) On the grid, draw the graph of $y = 2x^2 + 5x - 3$ for $-4 \leq x \leq 1.5$ --- [4]

(c) Use your graph to solve the equation:
 $2x^2 + 5x - 3 = 3$ --- [2]

(d) $y = 2x^2 + 5x - 3$ can be written in the form $y = 2(x+a)^2 + b$ --- [3]
Find the value of a and the value of b .



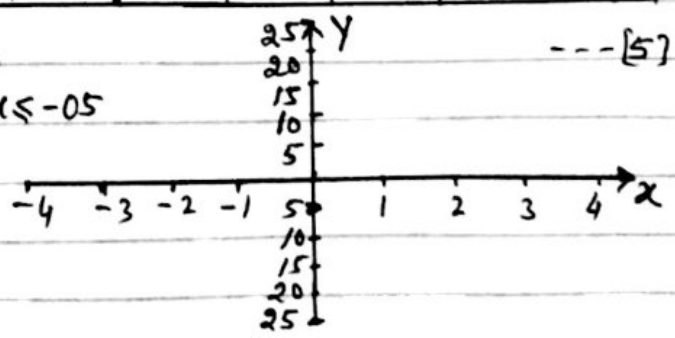
W-17/43/27

Q 93 $y = x^2 - 2x + \frac{12}{x}$, $x \neq 0$

(a) Complete the table of values: --- [2]

x	-4	-3	-2	-1	-0.5	0.5	1	2	3	4
y	21	11		-9	-22.75	23.25	11	6		11

(b) On the grid, draw the graph of $y = x^2 - 2x + \frac{12}{x}$ for $-4 \leq x \leq -0.5$ and $0.5 \leq x \leq 4$. --- [5]



(Continued ->)

(Continued →)

Q93(C) By drawing a suitable tangent, find an estimate of the gradient of the graph at the point (1,1). ---[3]

(d) The equation $x^2 - 2x + \frac{12}{x} = k$ has exactly two distinct solutions. Use graph to find (i) the value of k . ---[1]

(ii) the solutions of $x^2 - 2x + \frac{12}{x} = k$ ---[2]

(e) The equation $x^3 + ax^2 + bx + c = 0$ can be solved by drawing the line $y = 3x + 1$ on the grid. Find the values of a, b and c . ---[3]

S-15/42/Q5

Q94 $f(x) = \frac{8}{x^2} + \frac{x}{2}, x \neq 0$

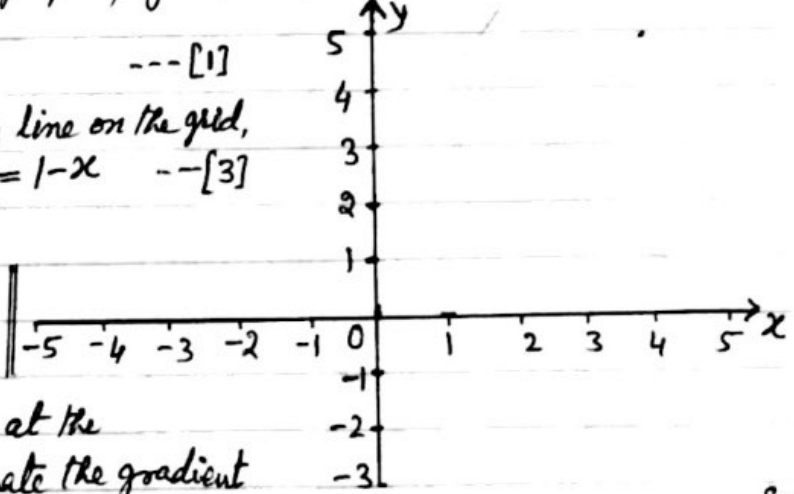
(a) Complete the table of values for $f(x)$. ---[3]

x	-5	-4	-3	-2	-1.5	1.5	2	2.5	3	3.5	4	5
$f(x)$	-2.2	-1.5	-0.6		2.8	4.3		2.5	2.4	2.4		2.8

(b) On the grid, draw the graph of $y = f(x)$ for $-5 \leq x \leq -1.5$ and $1.5 \leq x \leq 5$

(c) Solve $f(x) = 0$ ---[1]

(d) By drawing a suitable line on the grid, solve the equation $f(x) = 1 - x$ ---[3]



(e) By drawing a tangent at the point $(-3, -0.6)$, estimate the gradient of the graph of $y = f(x)$ when $x = -3$. ---[3]

S-15/43/Q3

Q95 $f(x) = 2x - 1$ $g(x) = x^2 + x$ $h(x) = \frac{2}{x}, x \neq 0$

(a) Find $f \circ f(3)$ ---[2]

(b) Find $g \circ f(x)$, giving your answer in its simplest form. ---[3]

(c) Find $f^{-1}(x)$ ---[2]

(d) Find $h(x) \cdot h(x+2)$, giving your answer as a single fraction. ---[4]

S-15/43/Q10

Q96 The table shows some values for $y = x^3 - 3x + 2$

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y		3.125		3.375	2		0		4

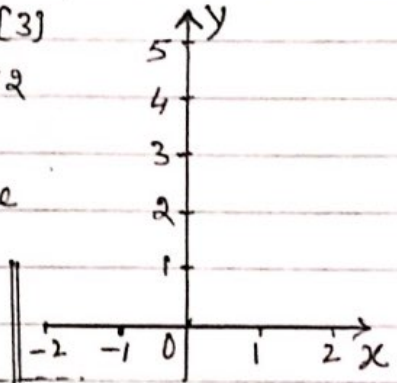
(a) Complete the table of values. --- [4]

(b) On the grid, draw the graph of $y = x^3 - 3x + 2$ for $-2 \leq x \leq 2$. --- [4]

(c) By drawing a suitable line, --- [3]

solve the equation, $x^3 - 3x + 2 = x + 1$ for $-2 \leq x \leq 2$

(d) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where $x = -1.5$ --- [3]



Q97 $f(x) = 2x + 5$ $g(x) = 2^x$ $h(x) = 7 - 3x$

(a) Find (i) $f(3)$ --- [1]

(ii) $gg(3)$ --- [2]

(b) Find $f^{-1}(x)$ --- [2]

(c) Find $fh(x)$, giving your answer in its simplest form. --- [2]

(d) Find the integer value of x which satisfy this inequality, $1 < f(x) \leq 9$ --- [3]

W-15/42/Q9

Q98 $f(x) = x - \frac{1}{2x^2}$, $x \neq 0$

(a) Complete the table of values. --- [2]

x	-3	-2	-1.5	-1	-0.5	-0.3	0.3	0.5	1	1.5	2
$f(x)$	-3.1	-2.1	-1.7		-2.5	-5.9	-5.3	-1.5		1.3	1.9

(b) On the grid, draw the graph of $y = f(x)$ for $-3 \leq x \leq -0.3$ and $0.3 \leq x \leq 2$. --- [5]

(c) Use your graph to solve the equation $f(x) = 1$. --- [1]

(d) There is only one negative integer value, k , for which $f(x) = k$, has only one solution for all real x . Write down this value of k . --- [1]

(e) The equation $2x - \frac{1}{2x^2} - 2 = 0$ can be solved using the graph of $y = f(x)$ and a line graph. (i) Find the equation of this line. --- [1]

(ii) Draw this line and solve the equation: $2x - \frac{1}{2x^2} - 2 = 0$. --- [3]

W-15/43/Q4

Q99

$f(x) = 2x - 1$

$g(x) = \frac{1}{2x}, x \neq 0$

$h(x) = 2^x$

my companion

- (a) Find $h(3)$ --- [1]
- (b) Find $fg(0.5)$ --- [2]
- (c) Find $f^{-1}(x)$ --- [2]
- (d) Find $ff(x)$, giving your answer in its simplest form. --- [2]
- (e) Find $(f(x))^2 + 6$, giving your answer in its simplest form. --- [2]
- (f) Simplify $fh^{-1}(x)$ --- [1]
- (g) which of the following statements is true?
 $f^{-1}(x) = f(x)$
 $g^{-1}(x) = g(x)$
 $h^{-1}(x) = h(x)$ --- [1]
- (h) Use two of the functions $f(x)$, $g(x)$ and $h(x)$ to find the composite function which is equal to $2^{x+1} - 1$. --- [1]

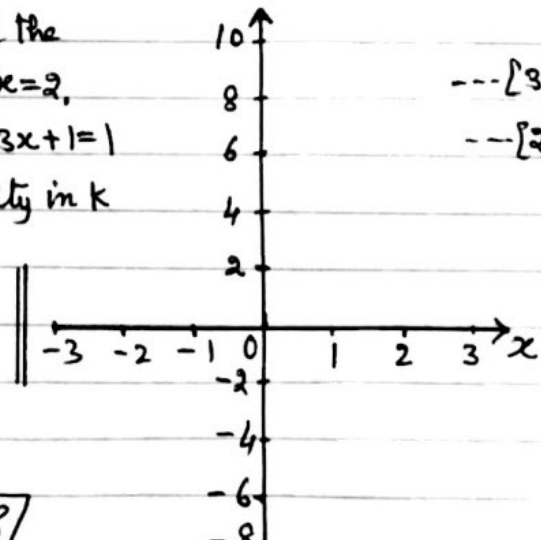
W-15/43/Q9

Q100

(a) Complete the table of values for $y = x^3 - 3x + 1$ --- [2]

x	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5
y	-7.125	-1		3		1	-0.375	-1	-0.125	3	9.125

- (b) Draw the graph of $y = x^3 - 3x + 1$ for $-2.5 \leq x \leq 2.5$ --- [4]
- (c) By drawing a suitable tangent, estimate the gradient of the curve at the point where $x=2$. --- [3]
- (d) Use your graph to solve the equation $x^3 - 3x + 1 = 1$ --- [2]
- (e) Use your graph to complete the inequality in k for which the equation, $x^3 - 3x + 1 = k$ has three different solutions. --- [2]



S-14/41/Q8

Q101

- (a) $f(x) = 2x - 3$ $g(x) = \frac{1}{x+1} + 2$ $h(x) = 3^x$
- (i) Work out $f(4)$ --- [1]
- (ii) Work out $fh(-1)$ --- [2]
- (iii) Find $f^{-1}(x)$, the inverse of $f(x)$. --- [2]

(Continued →)

(Continued →)

Q.101(a)(iv) Find $f(x)$ in its simplest form. ---[2]

(v) Show that the equation $f(x) = g(x)$ simplifies to $2x^2 - 3x - 6 = 0$ ---[3]

(vi) Solve the equation $2x^2 - 3x - 6 = 0$ Give your answers correct to 2 decimal places. Show all your working. ---[4]

(b) Simplify $\frac{x^2 - 3x + 2}{x^2 + 3x - 10}$ -----[4]

S-14/41/Q10

Q.102 $f(x) = \frac{1}{x^2} - 2x$, $x \neq 0$

(a) Complete the table of values for $f(x)$. ---[3]

x	-3	-2.5	-2	-1.5	-1	-0.5	0.4	0.5	1	1.5	2
$f(x)$	6.1	5.2	4.3	3.4		5	5.5			-2.6	-3.8

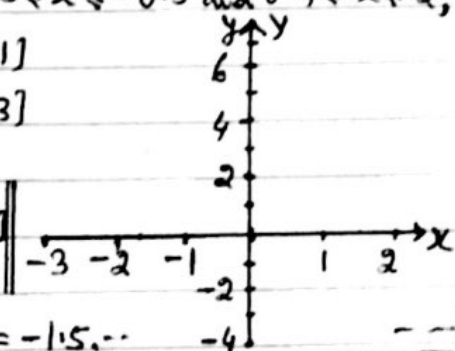
(b) On the grid, draw the graph of $y = f(x)$ for $-3 \leq x \leq -0.5$ and $0.4 \leq x \leq 2$; ---[5]

(c) Solve the equation $f(x) = 2$ ---[1]

(d) Solve the equation $f(x) = 2x + 3$ ---[3]

(e) (i) Draw the tangent to the graph of $y = f(x)$ at the point where $x = -1.5$; ---[1]

(ii) Use the tangent to estimate the gradient of the graph of $y = f(x)$ at $x = -1.5$; ---[2]



S-14/42/Q2

Q.103 $f(x) = \frac{1}{x}$, $x \neq 0$ $g(x) = 1 - x$ $h(x) = x^2 + 1$

(a) Find $fg(\frac{1}{2})$ ---[2]

(b) Find $g^{-1}(x)$, the inverse of $g(x)$. ---[1]

(c) Find $hg(x)$, giving your answer in its simplest form. ---[3]

(d) Find the value of x when $g(x) = 7$ ---[1]

(e) Solve the equation $h(x) = 3x$, show your working and give your answers correct to 2 decimal places. ---[4]

(f) A function $k(x)$ is its own inverse when $k^{-1}(x) = k(x)$ for which of the functions $f(x)$, $g(x)$ and $h(x)$ is this true? ---[1]

S-14/42/Q10

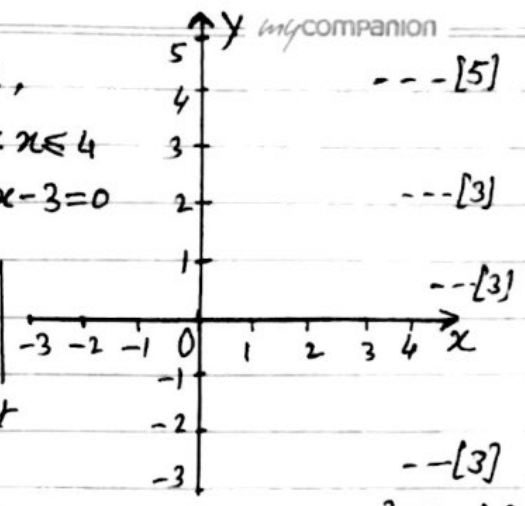
Q.104 The table shows some values for the function, $y = \frac{1}{x^2} + x$, $x \neq 0$

x	-3	-2	-1	-0.5	0.5	1	2	3	4
y	-2.89	-1.75		3.5		2	2.25		4.06

(a) Complete the table of values. (continued →) ---[3]

(Continued →)

Q104 (b) On the grid, draw the graph of $y = \frac{1}{x^2} + x$,
for $-3 \leq x \leq -0.5$ and $0.5 \leq x \leq 4$



(c) Use your graph to solve the equation $\frac{1}{x^2} + x - 3 = 0$

(d) Use your graph to solve the equation,
 $\frac{1}{x^2} + x = 1 - x$

(e) By drawing a suitable tangent, find an estimate of the gradient of the curve at the point where $x = 2$

(f) Using algebra, show that you can use the graph at $y = 0$ to find $\sqrt[3]{-1}$

S-14/43/Q4

Q105 $f(x) = 4 - 3x$ $g(x) = 3^{-x}$

(a) Find $f(2x)$ in terms of x .

(b) Find $ff(x)$ in its simplest form.

(c) Work out $gg(-1)$, Give your answer as a fraction.

(d) Find $f^{-1}(x)$, the inverse of $f(x)$.

(e) Solve the equation $gf(x) = 1$

S-14/43/Q9

Q106 (a) Complete the table of values for $y = x^2 + \frac{3}{x}$, $x \neq 0$

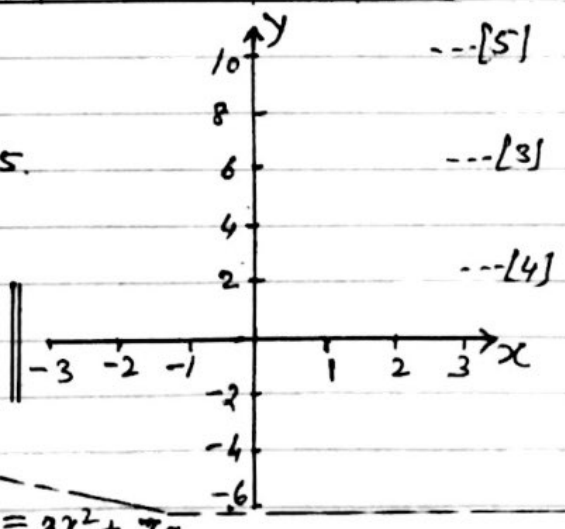
Q106

x	-3	-2	-1	-0.5	0.4	0.6	1	1.5	2	3
y	8	2.5		-5.8	7.7	5.4	4	4.3		10

(b) Draw the graph of $y = x^2 + \frac{3}{x}$,
for $-3 \leq x \leq -0.5$ and $0.4 \leq x \leq 3$.

(c) Use your graph to solve the equation $x^2 + \frac{3}{x} = 5$.

(d) By drawing a suitable straight line,
solve the equation $x^2 + \frac{3}{x} = x + 5$.



S-14/41/Q5

Q107 $f(x) = 5x - 2$ $g(x) = \frac{7}{x-3}$, $x \neq 3$, $h(x) = 2x^2 + 7x$

(a) Work out,

(i) $f(2)$

(ii) $hg(17)$

(Continued →)

(→ Continued)

- Q107 (b) Solve $g(x) = x + 3$ --- [3]
 (c) Solve $f(x) = 11$, showing all your working and giving your answers correct to 2 decimal places. --- [5]
 (d) Find $f^{-1}(x)$ --- [2]
 (e) Solve $g^{-1}(x) = -0.5$ --- [1]

W-14/42/Q5

Q108 $f(x) = 5x^3 - 8x^2 + 10$

- (a) Complete the table of values. --- [3]

x	-1.5	-1	-0.5	0	0.5	0.75	1	1.5	2
$f(x)$	-24.9			10	8.6	7.6	7		18

- (b) Draw the graph of $y = f(x)$ for $-1.5 \leq x \leq 2$ --- [4]

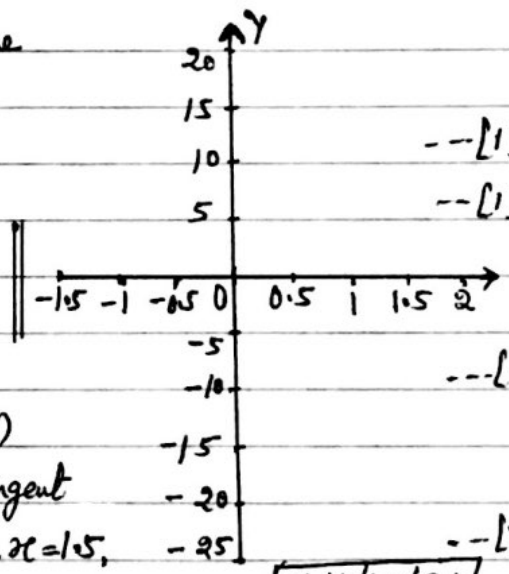
- (c) Use your graph to find an integer value of k so that $f(x) = k$ has

- (i) exactly one solution. --- [1]
 (ii) three solutions. --- [1]

- (d) By drawing a suitable line on the graph, solve the equation.

$f(x) = 15x + 2$ for $-1.5 \leq x \leq 2$.

- (e) Draw a tangent to the graph of $y = f(x)$ at the point where $x = 1.5$. Use your tangent to estimate the gradient of $y = f(x)$ when $x = 1.5$. --- [3]



W-14/42/Q6

Q109 $f(x) = 3 - x - x^2$ $g(x) = 3^x$

- (a) Complete the tables of values for $f(x)$ and $g(x)$.

x	-1.5	-1	-0.5	0	0.5	1	1.5
$f(x)$	2.25	3	3.25		2.25	1	-0.75

x	-1.5	-1	-0.5	0	0.5	1	1.5
$g(x)$	0.19		0.58		1.73	3	5.20

[3]

(Continued →)

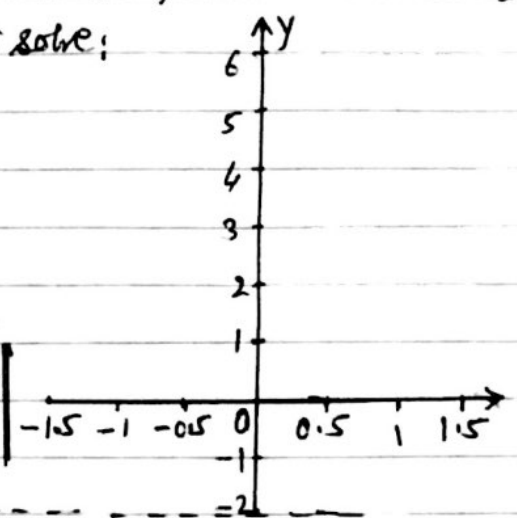
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Q109 (b) On the grid, draw the graph of $y=f(x)$ and $y=g(x)$ for $-1.5 \leq x \leq 1.5$... [6]

(c) for $-1.5 \leq x \leq 1.5$, use your graph to solve:

- (i) $f(x)=0$ --- [1]
- (ii) $g(x)=4$ --- [1]
- (iii) $f(x)=g(x)$ --- [1]

(d) By drawing a suitable tangent, find an estimate of the gradient of the graph of $y=f(x)$ when $x=0.5$... [3]



S-13/41/Q2

Q110 $f(x) = x^2 + x - 3$ $g(x) = 2x + 7$ $h(x) = 2^x$

- (a) Solve the equation $f(x) = 0$, show all your working and give your answers correct to 2 decimal places. --- [4]
- (b) $fg(x) = px^2 + qx + r$, find the value of p , q and r . --- [3]
- (c) Find $g^{-1}(x)$ --- [2]
- (d) Find x when $h(x) = 0.25$ --- [1]
- (e) Find $hkh(3)$, Give your answer in standard form, correct to 4 significant figures. --- [4].

S-13/41/Q9

Q111 The table shows some values for the function $y = 11x - 2x^2 - 12$ for $1 \leq x \leq 4.5$

x	1	1.5	2	2.5	3	3.5	4	4.5
y	-3		2	3	3			

- (a) Complete the table of values. --- [3]
- (b) On the grid below, draw the graph of $y = 11x - 2x^2 - 12$ for $1 \leq x \leq 4.5$... [4]

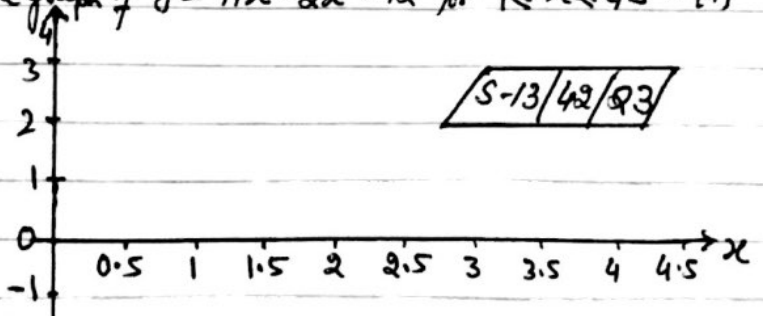
(c) By drawing a suitable line, use your graph to solve the equation.

$11x - 2x^2 = 11$ --- [2]

(d) The line $y = mx + 2$ is a tangent to the curve $y = 11x - 2x^2 - 12$ at the point P. By drawing this tangent,

- (i) Find the coordinates of point P. --- [2]; (ii) Work out the value of m . --- [2]

S-13/42/Q3



Q112 (a) Complete this table of values for the function $f(x) = \frac{1}{x} - x^2$, $x \neq 0$ --- [3]

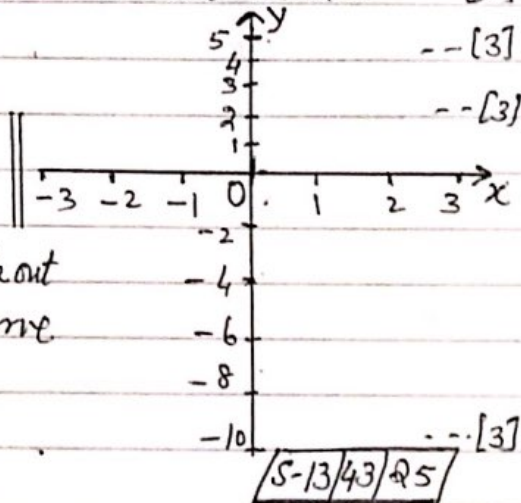
x	-3	-2	-1	-0.5	-0.2	0.2	0.5	1	2	3
$f(x)$	-9.33	-4.5	-2	-2.25		4.96			-3.5	-8.67

(b) Draw the graph of $f(x) = \frac{1}{x} - x^2$ for $-3 \leq x \leq -0.2$ and $0.2 \leq x \leq 3$. --- [5]

(c) Use your graph to solve $f(x) = -3$ --- [3]

(d) By drawing a suitable line on your graph, solve the equation, $f(x) = 2x - 2$ --- [3]

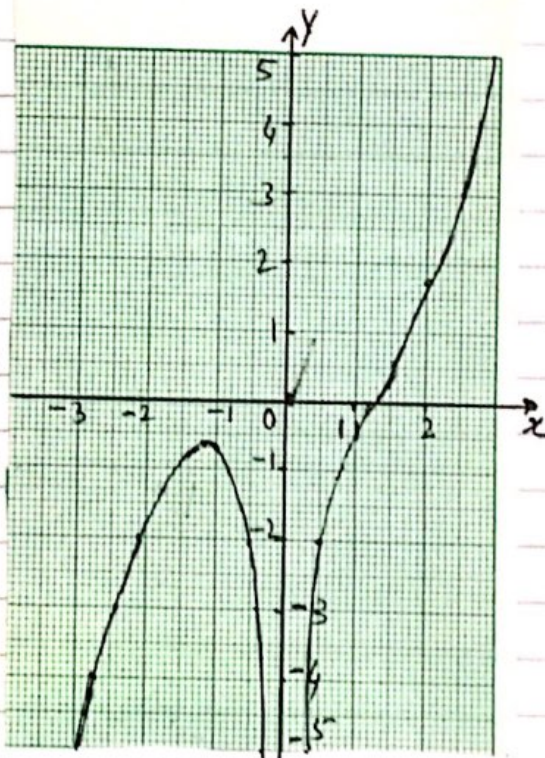
(e) By drawing a suitable tangent, work out an estimate of the gradient of the curve at the point where $x = -2$. You must show your working. --- [3]



Q113 (a) The diagram shows the graph of $y = f(x)$ for $-3 \leq x \leq 3$.

- (i) Find $f(2)$ --- [1]
- (ii) Solve the equation $f(x) = 0$ --- [1]
- (iii) Write down the value of the largest integer, k , for which the equation $f(x) = k$ has 3 solutions. --- [1]
- (iv) By drawing a suitable line, solve the equation $f(x) = x$ --- [3]

- (b) $g(x) = 1 - 2x$ $h(x) = x^2 - 1$
- (i) Find $gh(3)$ --- [2]
- (ii) Find $g^{-1}(x)$ --- [2]
- (iii) Solve the equation $h(x) = 3$, --- [3]
- (iv) Solve the equation $g(3x) = 2x$ --- [3]



Q114 (a) Complete the table of values for $y = \frac{2}{x^2} - \frac{1}{x} - 3x$ --- [3]

x	-3	-2	-1	-0.5	-0.3	0.3	0.5	1	2	3
y	9.6		6		26.5	18.0		-2	-6	-9.1

(Continued →)

(→ Continued)

Q114 (b) Draw the graph of $y = \frac{2}{x^2} - \frac{1}{x} - 3x$

for $-3 \leq x \leq -0.3$ and $0.3 \leq x \leq 3$

(c) Use your graph to solve these equations,

(i) $\frac{2}{x^2} - \frac{1}{x} - 3x = 0$ --- [5]

(ii) $\frac{2}{x^2} - \frac{1}{x} - 3x - 7.5 = 0$ --- [3]

(d) (i) By drawing a suitable line on the graph, solve the equation,

$$\frac{2}{x^2} - \frac{1}{x} - 3x = 10 - 3x$$

--- [4]

(ii) The equation $\frac{2}{x^2} - \frac{1}{x} - 3x = 10 - 3x$ can be written in the form, $ax^2 + bx + c = 0$, where a, b, c are integers.

Find the value of a, b and c .

[W13/42/25] --- [3]

Q115 $f(x) = 4x + 3$ $g(x) = \frac{7}{x+1}$ ($x \neq -1$) $h(x) = x^2 + 5x$

(a) work out (i) $h(-3)$ --- [1]

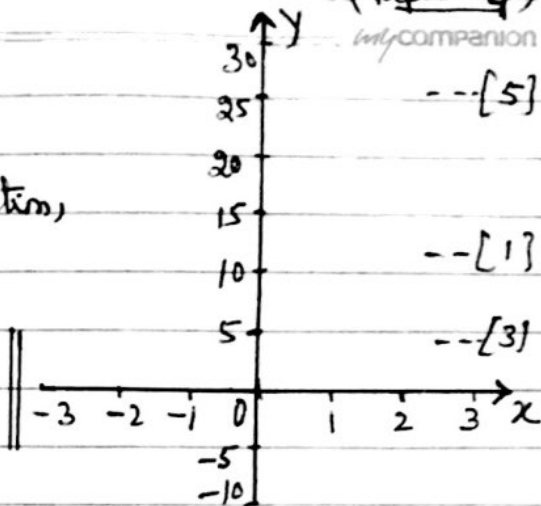
(ii) $hg(13)$ --- [2]

(b) Find $f^{-1}(x)$ --- [2]

(c) (i) solve the equation $f(x) = 23$ --- [2]

(ii) solve the equation $h(x) = 7$ show all your working and give your answer correct to 2 decimal places, --- [5]

[W13/42/28]



Answers

Q1 (a) 0, 1, 2, 3 (b) $\frac{x-2}{x-5}$
(c) (ii) 4.88 and -0.55

Q2 (a) 1, -1, 3.5
(b) 10 correct points plotted.
(c) (i) -2.2 to -2.1,
-0.65 to -0.45
and 2.5 to 2.7

(d) (i) Ruled line gradient 3 and
y-intercept -2 (-1 to 3.5)
(ii) $a = -12$, $b = 2$
(iii) 0.1 to 0.2 and 3.3 to 3.4

Q3 (a) (i) There are upto 5 large
coaches. (ii) $50x + 30y \geq 300$

(b) $x = 5$ ruled,
 $x + y = 10$ ruled
 $5x + 3y = 30$ ruled.

corrected region indicated.

(c) (i) 5, 2
(ii) \$2950.

Q4 (a) 0, 0.5 and 1.25
(b) Fully correct smooth curve.
(c) 3.6 to 3.8
(d) line $y = x + 1$ ruled.
-1.55 to -1.40; 4.55 to 4.8

(e) (i) point plotted at (5, 5)
(ii) Tangent ruled from A,
(iii) 1.2 to 1.4.

Q5 (a) (i) $(3x-1)(x+4)$ (ii) $\frac{1}{3}$; -4
(b) (i) - - simplify
(ii) -2.64 and 1.14

Q6 (a) $x < 10$ and $y \geq 2$

(b) $x + 3y \leq 21$

(c) ruled broken line $x = 10$ (11 to y-axis)
ruled line $y = 2$ (parallel to x-axis)
ruled line from (0, 7) to (21, 0)

(d) (i) 4 (ii) \$20

Q7 (a) 4, 5, 6, 7
8, 16, 32, 64, 128

(b) 2^n (c) (i) $2 + 4 + 8 = 14$
(ii) 62 and 6

(iii) $2^{n+1} - 2$ (iv) 9.

Q8 (a) (i) $-7x + 55$ (ii) $x^2 - 14x + 49$

(b) (i) -18 (ii) 15 (iii) 5 or -5

Q9 (a) -1.6 to -1.4 (b) -0.5

(c) $k > -4$ (d) $y = x - 5$ ruled
and -2.3 to -2.1; -1.2 to -1.1 and
1.3 to 1.4

(e) Tangent ruled at $x = 1$
-6 to -4

Q10 (a) (i) 5, 13 (ii) as $n = 25 \frac{3}{4} \notin \mathbb{N}$

(b) (i) $6n + 7$ (ii) $n^2 + n + 2$

(c) $y = 10$; first term = 14

Q11 (a) -1.75 to -1.7 and 1.7 to 1.75

(b) correct ruled tangent at (-1.5, 3.5)

(ii) -7 to -5 (c) (i) 1 (ii) correct curve,

(d) (i) -0.95 to -0.8 and 1.1 to 1.45

(ii) $(-0.95 \text{ to } -0.8) < x < (1.1 \text{ to } 1.45)$

(e) (i) 0.125, 0.03125 and

0.000976 to 0.000977.

(ii) 0.

Answers

Q12(a)(i) 4.5 or $4\frac{1}{2}$
(ii) $5x^2 - 20x - 5 = 0$
 $x = 4.2408$ or 4.236
(b) (i) $(x+5)(x-1)$ (ii) $-5; 1$

Q13 (a) -11 (b) 7 (c) 25
(d) $9x^2 - 8x + 2$ (e) $\frac{x+2}{3}$

Q14 (a) 0 2.25 2 1.25
(b) Fully correct smooth curve
(c) 1 (d) (i) $y = x + 1$
(d) (ii) -2.2 to -2.1 ; -0.45 to -0.4
and 0.51 to 0.6
(e) $-1.33 < k < 0$ to 0.1

Q15 (a) $x = -5$; $y = 7$
(b) $a = 36$; $b = -6$
(c) $\frac{7x^2 - 12x - 10}{(2x-5)(x-1)}$

Q16. A $\rightarrow 64, (n+3)^2$
B $\rightarrow 17, (3n+2)$
C $\rightarrow 47, (n+3)^2 - (3n+2)$
D $\rightarrow \frac{7}{6}; \frac{n+2}{n+1}$

Q17 (a) $3.50, 1.94, 3.11$
(b) Fully correct curve.
(c) 7 to -0.6 , (d) (i) $-1, 2.5$
(e) correct tangent and
 $0.5 \leq \text{grad} \leq 0.85$

Q18 (a) 15 (b) $\frac{x+6}{x-2}$
(c) $\frac{x}{x^2+1}$ (d) $\frac{-7x-1}{x^2-1}$

Q19 (a) (i) 11 (ii) $14x+3$
(b) $17 - 21x$
(c) $-\frac{1}{9}$ (d) -1.3

Q20 (a) $9, 10.5$
(b) Fully correct curve
(c) 2.1 to 2.6 ; 8.5 to 9
(d) $2, 3, 5, 7$. (e) $(-2, -12)$

(f) (i) $x^3 - x^2 - 20 = 0$
(ii) Fully correct curve $y = x^2$
(iii) 2.5 to 3.5
(iv) 3.0 to 3.1

Q21 (a) $A = \frac{1}{2}(80-20) \cdot x \Rightarrow x^2 - 40x + A = 0$
(a) (ii) $(x-30)(x-10) = 0 \Rightarrow x = 30; 10$
(iii) $5.86; 34.14$
(b) (i) $\frac{200}{x} - \frac{200}{x+10} \Rightarrow \frac{2000}{x(x+10)}$
(ii) $16 \text{ min } 40 \text{ sec.}$

Q22 (a) 2 (b) 17 (c) $\frac{x-1}{2}$
(d) $x^2 + 4x + 5$ (e) $\sqrt{2}$ or 1.41 (f) -1

Q23 (a) (i) 5 (ii) $\frac{1}{2}$ (iii) $5/3$ (iv) $-2/3$
(b) $(y-10)(y+3); 10, -3$

Q24 (a) (i) $-2, -0.5$ or $-\frac{1}{2}$
(ii) complete correct curve.
(b) -1.95 to -1.8 ; -0.4 to -0.2 ; 2.05 to 2.2
(c) Any integer k where $k \leq -3$
(d) (i) correct line $y = -5x - 2$ ruled.
(ii) $a = 5$ and $b = -2$

Q25 (a) (i) -3 (ii) $\frac{4}{5x+4}$ (iii) $\frac{4+3x}{x}$
(iv) 2
(b) (i) $(x+7)(x-3) = 4 \Rightarrow 5x^2 - 8x - 25 = 0$
(ii) -1.57 and 3.17

Q26 (a) $x > 12/5$ (b) (i) $(y-6)(x+3)$
(b) (ii) $8(x+3y)(x-3y)$ (c) $k = \frac{1}{p+7}$

Q27 (a) (i) $\frac{12}{x-1} - \frac{10}{x} = 0.5 \Rightarrow x^2 - 5x - 20 = 0$
(ii) $-2.62; 7.62$
(iii) $1 \text{ hr } 49 \text{ min}$

Q28 (a) (i) 10

(ii) $-3.4 \leq -3.3$; $-0.4 \leq -0.3$
and $1.6 \leq 1.7$.

(iii) $y = -2.3 \leq -2.1$; $y = 10 \leq 10.1$

(b) (i) 2, -1, 4

(ii) Fully curve drawn.

(iii) $-3.4 \leq -3.2$ and $1.8 \leq 1.9$

(c) 3.2 (d) 1

Q29 (a) $\begin{matrix} 10 & 15 \\ 15 & 21 \\ 35 & 48 \end{matrix}$

(b) (i) 3 (ii) 143

(c) $a = \frac{1}{2}$; $b = \frac{3}{2}$

(d) (i) 171 (ii) 673

Q30 (a) 0.92, 0.5, -1, -1, 0.5, 0.92

(b) Fully correct graph.

(c) (i) correct ruled line through $(-2, -1)$ and $(2, -3)$

(ii) $0.7 \leq 0.95$

(iii) $p = 2$ and $q = -2$

(d) (i) $(1.3 \leq 1.6, 0)$

(ii) ruled line from $(0, -2)$ to the intersection of their graph with positive x -axis

(iii) Tangent to curve A $(1.3 \leq 1.6, 0)$

Q31 (a) $\frac{323}{x} + \frac{323}{x+2} = 36$

$\Rightarrow 18x^2 - 287x - 323 = 0$

(b) (i) 17; 19

(ii) $(\dots + 19)(\dots - 17)$

(iii) 17, $-\frac{17}{18}$

(c) 11

Answers / Q22(a) 236 (b) $6x+1$

(c) $x < 3$ (d) -2 (e) $\frac{x+3}{2}$

(f) $\frac{6x^2 - x + 3}{2x+1}$ (g) 9.

Q33 (a) 1, 1 (b) Fully correct graph.

(c) (i) $-1 < \text{ans} < -0.8$, $1.25 < \text{ans} < 1.45$
 $2.5 < \text{ans} < 2.6$ (ii) $-0.7 < \text{ans} < -0.5$

(d) (i) $y = 1 \leq 1.1$; $y = -0.4 \leq -0.33$

(ii) $-0.4 \leq -0.33$

Q34 (i) $x+y \geq 9$; $y \geq 2$

(ii) unwanted region shaded.

(iii) 20; $x = 17$ and $y = 2$

Q35 (a) 54.50

(b) (i) $\frac{1000}{x(x+1)}$ (ii) $\frac{1000}{x} - \frac{1000}{x+1} = 4.5$

$\Rightarrow 9x^2 + 9x - 2000 = 0$

(iii) -15.42, 14.42

(iv) $69.34 \leq 69.37$

Q36 (a) (i) 1.5 (ii) $\frac{3}{y-2}$

(b) (i) -3 (ii) 65 536 (iii) -6 (iv) 3

Q37 (a) -4.5 and 10.5

(b) correct curve (c) 5

(d) Line $y = 15 - 3x$ ruled and $-0.4 \leq -0.31$; $0.35 \leq 0.45$; $2.2 \leq 2.3$

(ii) $a = 6$, $b = -14$, $c = 0$

Q38 (a) 2.25 (b) $x \geq 3.5$

(c) $(x-7)(x+3)$ (d) $12x^2 + xy - 6y^2$

Q39 5 and $-2\frac{7}{2}$

Q40 (a) 2, 0, -2, 2

(b) smooth correct curve.

(c) line $y = \frac{1}{2}(x+1)$ ruled and

$-2.85 \leq -2.95, -1$, $0.85 \leq .95$

(d) $-1.1 \leq -1.5$

Q41 (a) $(11y-m)(11y+m)$

(b) $\frac{3x^2 + 5x - 14}{(3x-5)(x-1)}$

(c) $-1.90, 1.23$

(d) (i) $\frac{1}{2}(x+4+3x+2) \times (x+1) = 15$

$\Rightarrow 2x^2 + 5x - 12 = 0$

(ii) 1.5 or $\frac{3}{2}, -4$

(iii) 6.5 or $\frac{13}{2}$

Q42 (a) $4x + 10y < 80$

(b) $y > x; y \leq 6$ or $y < 7$

(c) ruled line through $(5, 6)$ to $(10, 4)$

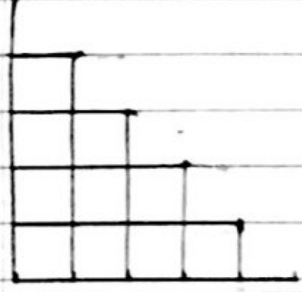
ruled broken line $y = x$

ruled solid line $y = 6$ or broken $y = 7$

correct region indicated.

(d) 76

Q43 (a)



(b) 30
10

(c) $n(n+1)$

(d) $\frac{1}{2}n(n-1)$

Q44 (a) $1.5, 1.25, -0.75, 0.5$

(b) Fully correct curve

(c) -1.35 to -1.25 ; -0.27 to -0.25
and 1.51 to 1.55

(d) $k < 1.2$ or 1.15 to 1.25

(e) tangent ruled at $x = -1$

Q45 (a) $5x = 75$ or $5x + 48 = 123; 15$

(b) 6, 7 (c) (i) 1.8

(ii) -2.91 and 0.57

Answers

Q46 (a) -2.75 or $-2\frac{3}{4}$

(b) (i) $(x+11)(x-2)$ (ii) -11 and 2

(c) $x = \frac{2a}{2-y}$ or $\frac{-2a}{y-2}$

(d) $\frac{x}{x+6}$

Q47 (a) (i) $7a + 9b = 354$

(ii) $a = 2, b = 23$

(b) (i) $\frac{2}{x}$ (ii) $\frac{2}{x} + \frac{3}{x-1} = 2$

(ii) (a) $2x^2 - 7x + 2 = 0$

(b) 3.19 only

Q48 (a) 343 (b) (i) 1 (ii) x^{10} (iii) $9x^{16}$

(c) (i) $2(x-3)(x+3)$ (ii) $\frac{2(x+3)}{x+10}$

Q49 (a) $\frac{10}{x-0.5}$ (b) (i) $\frac{10}{x-0.5} - \frac{10}{x} = 0.25$

$\Rightarrow 2x^2 - x - 40 = 0$

(b) (ii) -4.23 and 4.73

(iii) 2 for 7 min.

Q50 (a) (i) $\frac{600}{x+20}$ (ii) $\frac{600}{x} - \frac{600}{x+20} = 1.5$

or $x^2 + 20x - 8000 = 0$

(b) $-100, 80$ (c) 6.67 or 6.667

Q51 (a) $4x - 3x^2$ or $x(4-3x)$

(b) (i) $(2+y)(3w-2x)$

(ii) $(2x+5y)(2x-5y)$ (c) $\frac{27x^6}{64}$

(d) (i) $2n$ is even, so subtract 1 is odd.

(ii) $2n+1$ (iii) $(2n+1)^2 - (2n-1)^2 = 8n$

Q52 (a) 1.6 (b) (i) 7 (ii) 4 (iii) 7

(iv) $\frac{1}{3}$

(c) (i) 0.25 and 1 (ii) correct graph

(iii) 2.3 (iv) $y = 3x - 1$

(v) -1.7 to -1.5 and 2.

Q53 (a) $(x-5)(x+2)$ **Answers** Q60(a) $x > 0.5$

b(i) $x^2 + 5x + 3 = 3x^2 + 3x$
 $\Rightarrow 2x^2 - 2x - 3 = 0$

(ii) $0.5 \pm \sqrt{1.75}$ or $-0.823; 1.823$

(c) $\frac{x^2 + 3x + 3}{x^2 + 3x + 2}$

Q54 (a) $4x(3x+13) - 2x(4x-3x-9) = 24$
 $\Rightarrow 5x^2 + 17x - 12 = 0$

(a)(ii) $(5x-3)(x+4) = 0$; $3/5, -4$

(b) $x = 3$; $y = -7$

(c) $t = -2$

Q55 (a) 83 (b) $1/3$ (c) 25

(a) (i) $\frac{1}{2}u(3u-2) = 2.5$

$\Rightarrow 3u^2 - 2u - 5 = 0$

(ii) $(3u-5)(u+1)$ (iii) 29.1 or 29.05

Q56 (a) (i) $\frac{600}{x}$ (ii) $\frac{600}{x+1}$

(b) (i) $\frac{600}{x} - \frac{600}{x+1} = 20$

$\Rightarrow x^2 + x - 30 = 0$

(ii) $x = 5$; speed = 100

Q57 (a) $2x^2 + (2x-3)(x+4) = 2(x+4)$

$\Rightarrow 2x^2 + 3x - 6 = 0$

(a)(ii) 1.14 and -2.64

Q58 (a) $\pm \sqrt{v^2 + 2av}$

(b) (i) $\frac{60}{x} + \frac{45}{x+4} = 6$

$\Rightarrow 2x^2 - 27x - 80 = 0$

(ii) 16

Q59 (a) (i) $11 - x$ (ii) $6x^2 - xy - 12y^2$

(b) $x(x^2 - 5)$ (c) $x \geq 4$ or $4 \leq x$

(d) (i) -2, 5.5 (ii) -8.25

(iii) $x = 4.5$

(b) (i) $(p-2)(q+4)$ (ii) $(3p-5)(3p+5)$

(c) $(5x-9)(x+2) = 0$

$9/5$; -2

Q61 (a) (i) x^8 (ii) $15x^7y^3$ (iii) $16x^8$

(b) 3.48, -1.15

(c) $\frac{x+5}{x^2}$ or $\frac{1}{x} + \frac{5}{x^2}$

Q62 (b) (i) $(x+5)(x-2)$

(ii) $a = -5$, $b = 2$, $c = -10$

(iii) $x = -1.5$

(d) (i) $p = 6$, $q = 43$

(ii) -43

Q63 (a) (i) $5x+14$ (ii) 14.2

(b) $40a - 15b = 92.5$ $\Rightarrow a = 3.25$

$40a + 32b = 210$ $b = 2.5$

Q64 (a) $\frac{27}{x}$ (b) $\frac{25}{x-2}$

(c) $\frac{25}{x-2} - 4 = \frac{27}{x}$

$\Rightarrow 2x^2 - 3x - 27 = 0$

(d) -3, 4.5

(e) 6

Q65 (a) (i) $\frac{25-8x}{20}$ (ii) $\frac{2x^2+5x+9}{3(x+3)}$

(b) $x = 2/3$ or 0.667 ; $y = -3$

(c) $\frac{7}{2x+3}$

Q66 (a) (i) 4.5 or $4\frac{1}{2}$

(ii) $(x-6)(x-1)$; 1, 6

(iii) 6

Q67 (a) -0.67; 2.05

(b) 132 (c) $\frac{x}{2.5} + \frac{x-14.50}{0.5} = 19$

or $x = 20$

Q68 (a) $\frac{4x-7}{10}$ (b) x^2+9
 (c) (i) $(2x-1)(x+3)$
 (ii) $\frac{2x-1}{2(x-3)}$ or $\frac{2x-1}{2x-6}$

Q69 (a) $\frac{2(s-ut)}{t^2}$ (b) 36.75

Q70 (a) $\frac{x}{x+3}$ (b) $\frac{3}{2}$ and -5

Sequences

Q71 (a) $18 \quad 22 \quad 4n+2$
 $17 \quad 26 \quad n^2+1$
 (b) $4 \times 60 + 2 = 242 \checkmark$
 (c) $n^2+1 = 226 \Rightarrow n=15 \checkmark$
 (d) 3

Q72 (a) $\frac{5}{7} \quad \frac{n}{n+2}$ } (b) 72
 $7 \quad n+2$
 $3 \quad n-2$ } (c) 27
 $21 \quad n^2-4$

Q73 (a) (i) 16 (ii) n^2
 (b) (i) 43 (ii) 7
 (c) $a = \frac{5}{2}, b = \frac{5}{6}$

Q74 (a) $\frac{8}{25}$ (b) $n+2$
 17 (c) (i) $(n-1)^2$
 (ii) 92
 (d) (i) n^2-3n-1
 (ii) 39

(e) $1, -\frac{1}{2}, \frac{1}{4}, -\frac{1}{8}$

Q75 $-13, -20, -7n+22$
 $\frac{9}{22}, \frac{10}{23}, \frac{n+4}{n+17}$
 $26, 37, n^2+1$
 $162, 486, 2 \times 3^{n-1}$

Answers Q76 (a) $\frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{2^{n-1}}$
 $2^{-3}, 2^{-4}, 2^{-5}, 2^{-(n-1)}$

(b) (i) $64, 256, 1024$
 $2^6, 2^8, 2^{10}$
 (ii) $2^{2(n-1)}$
 (c) 16384

Q77 (a) $36, 9, 45; 8n+4, (n-1)^2$
 (b) 19 (c) (i) $\frac{1}{3} + p + q = 12$
 (ii) $\frac{1}{3} \times 8 + 4p + 2q = 12 + 21$
 (iii) $p = \frac{7}{2}, q = \frac{49}{6}$

Q78 (a) $28 \quad 45$ } (b) (i) $4n-3$
 $17 \quad 21$ } (ii) 237
 $45 \quad 66$ } (iii) 50
 (c) $p=2; q=-5$
 (d) $2n^2-n$ or $n(2n-1)$

Q79 (a) $50 \quad 70 \quad 10n$
 $51 \quad 71 \quad 10n+1$
 (b) (i) 212 (ii) $20n+12$ (iii) $20n+152$
 (c) (i) $5 \times 3^2 + 6 \times 3 = 63$ and
 $11+21+31 = 63$
 (ii) 560
 (d) $5n^2 + 6n + (10(n+1)+1)$
 show $= 5(n+1)^2 + 6(n+1) \checkmark$

Q81 (a) (i) $1+2+3+4+5 = 15 \checkmark$
 (ii) for $n=1, \frac{1}{k}(1+1) = 1 \Rightarrow k=2 \checkmark$
 (iii) $\frac{60 \times (60+1)}{2} = 1830 \checkmark$
 (iv) $\frac{n(n+1)}{2} = 465 \Rightarrow n=30 \checkmark$
 (v) $(n-8)$
 (b) (i) 225, 15 (ii) $\frac{n^2(n+1)^2}{4}$ (iii) 36100

Q80 $a = \frac{1}{3}; b = \frac{1}{2}$

- Q82 (a) 48, 57 and $9n+3$
 (b) 56, 50 and $86-6n$
 (c) 125, 216 and n^3
 (d) 130, 222 and n^3+n

- Q83 (a) 15, 18 and $3(n+1)$
 6, 10, ---
 25, 36, $(n+1)^2$

(b) 14

(c) (i) $\frac{1}{2} + p + q = 9$

(ii) $p = 3, q = \frac{11}{2}$

Linear Programming

- Q84 (i) $x \geq 100$ (ii) $y \geq 120$
 (iii) $x + y \leq 300$ (iv) $40x + 80y \geq 16000$
 or $x + 2y \geq 400$

(b) $x = 100$ ruled; $y = 120$ ruled
 $x + y = 300$ ruled; $x + 2y = 400$ ruled
 correct shading

(c) 200

- Q85 (a) (i) $x \geq 5, y \leq 8$
 $x + y \leq 15, y > x$ (or $y \geq x + 1$)

(ii) $x = 5$ ruled, $y = 8$ ruled
 $x + y = 15$ ruled, $y = x$ Broken line
 Correct region indicated.

(b) 78

- Q86 (a) (i) $x \geq 5$ (ii) $y \geq 11$
 (iii) $x + y \geq 20$

(b) $4x + 8y \leq 160 \Rightarrow x + 2y \leq 40$

(c) (i) $x = 5$ ruled, $y = 11$ ruled.
 $x + y = 20$ ruled, $x + 2y = 40$ ruled
 Correct shading of unwanted region.

(ii) 29

Answers Q87 (a) $y = 2, y = 2x, y = -\frac{1}{2}x + 5$

(b) $y \geq 2, y \leq 2x, y \leq -\frac{1}{2}x + 5$

(c) (i) 4 bushes and 3 trees

(ii) 2 bushes and 4 trees.

860

Functions and Graphs

Q88 (a) 10, 7

(b) correct curve

(c) -1.7 to -1.55

4(d) Tangent ruled at $x = 3.5$
 6.5 to 11

(e) line $y = 2x + 10$ ruled and

-1.3 to -1.1; 1; 4.1 to 4.25

Q89 (a) -7, (b) $\frac{4}{64}$

(c) $\frac{3-x}{2}$ (d) 4^{3-2x} correctly
 interpret the indices.

(e) 1.5

Q90 (a) 3.2 (or 3.15); 5.2 (or 5.19)

(b) correct graph for $0.5 \leq x \leq 3.5$

(c) 1.7 to 1.8 (d) (i) any int $k \geq -1$
 (ii) any integer $k < -1$

(e) Tangent ruled at $x = -3$
 2.5 to 4

(f) (i) $y = 6 - x$ ruled accurately
 $2.85 \leq x \leq 3$

(ii) $a = 8, b = -48, c = -16$

Q91 (a) 3 (b) $-\frac{2}{5}$ (c) $-2x - 7$

(d) 26 (e) $\frac{1-x}{2}$ (f) $p = -20$
 $q = 26$

Q92(a) 9, -6, 9

(b) correct graph

(c) -3.5 to -3.35 and 0.8 to 0.9

(d) $a = 5/4$; $b = -\frac{49}{8}(x-6.125)$

Q93 (a) 2 and 7

(b) complete correct curve

(c) correct tangent and $-13 \leq x \leq -8$

(d) (i) 5 to 6

(ii) 2 to 2.35 and -2.55 to -2.35

(e) $a = -5$, $b = -1$, $c = 12$

Q94 (a) 1, 3, 2.5

(b) Fully correct graph

(c) -2.6 to -2.4

(d) correct line fit for purpose
-1.6 to -1.5

(e) correct tangent and $0.95 \text{ grad} \leq 1.5$

Q95 (a) 9 (b) $4x^2 - 2x$

(c) $\frac{x+1}{2}$ (d) $\frac{4x+4}{x(x+2)}$

Q96 (a) 0 4 0.625 0.875

(b) Fully correct smooth curve

(c) line $y = x + 1$ ruled and
0.2 to 0.3 and 1.8 to 1.95

(d) Tangent ruled at $x = -1.5$
2.2 to 5

Q97 (a) (i) 11 (ii) 256

(b) $\frac{x-5}{2}$ (c) $19 - 6x$

(d) -1, 0, 1, 2

Q98 (a) -1.5, 0.5 (b) correct curve

(c) 1.25 (d) -1

(e) (i) $2 - x$ (ii) Ruled line
with grad -1 through (0, 2) and
1.15 to 1.25

Answers / Q99 (a) 8 (b) 3 (c) $\frac{x+1}{2}$

(d) $4x - 3$ (e) $4x^2 - 4x + 7$ (f) x

(g) $g^{-1}(x) = g(x)$ (h) $f \circ h(x)$

Q100 (a) 2.125 and 2.375

(b) correct curve

(c) ruled tangent at $x = 2$ and
gradient from 7.8 to 10.2

(d) 0 ; -1.75 to -1.65 and 1.65 to 1.75

(e) -1.2 to -0.8 < k < 2.8 to 3.2

Q101 (a) (i) 5 (ii) $-2 \frac{1}{3}$ (iii) $\frac{x+3}{2}$

(iv) $4x - 9$ (v) $(2x-3)(x+1) = 1+2(x+1)$
 $\Rightarrow 2x^2 - 3x - 6 = 0$

(vi) 2.64 and -1.14

(b) $\frac{x-1}{x+5}$

Q102 (a) 3, 3, -1,

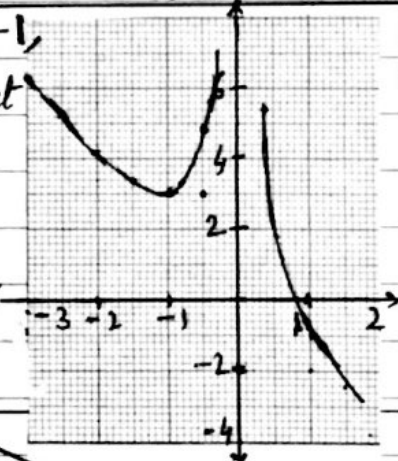
(b) complete correct curve

(c) 0.5 to 0.6

(d) correct line and
0.4 to 0.5

(e) (i) tangent at $x = -1.5$

(ii) -2 to -1



Q103 (a) 2 (b) $1 - x$

(c) $x^2 - 2x + 2$ (d) -6

(e) 0.38, 2.62 (f) $f(x)$ and $g(x)$

Q104 (a) 0, 4.5, 3.11

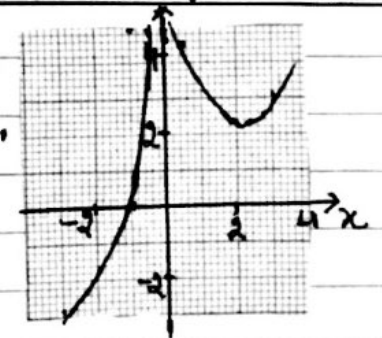
(b) correct curve with
minimum below 2,

(c) -0.5 to -0.6,
0.6 to 0.7, and
2.8 to 2.9

(d) -0.7 to -0.6

(e) 0.62 to 0.8

(f) $\frac{1}{x^2} = -x \Rightarrow 1 + x^3 = 0 \Rightarrow x = \sqrt[3]{-1}$



Q105 (a) $4-6x$ (b) $9x-8$

(c) $\frac{1}{27}$ (d) $\frac{4-x}{3}$ (e) $\frac{4}{3}$ or 1.33

Answers

Q110 (a) $-2.30, 1.30$

(b) 4, 30, 53

(c) $\frac{x-7}{2}$ (d) -2

(e) 1.158×10^{77}

Q106 (a) $-2, 5.5$

(b) Correct Curve

(c)

$-2.6 \leq x \leq -2.4$

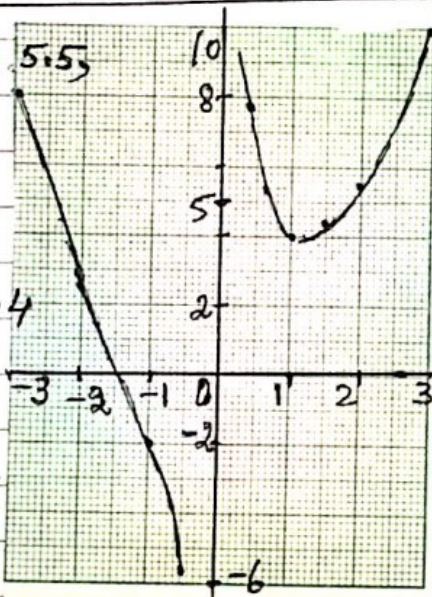
$0.6 \leq x \leq 0.7$

$1.8 \leq x \leq 1.9$

(d)

$y = x + 5$
ruled

and $-2.2 \leq x \leq -2.0$; $0.5x \leq 0.6$
and $2.4 \leq x \leq 2.6$



Q111 (a) 0, 2, 0, -3

(b) Correct curve

(c) $y = -1, x = 1.3$ to 1.4 and 4.1 to 4.2

(d) (i) line drawn from $(0, 2)$ to touch the curve $P(2.5$ to $2.75, 3$ to $3.4)$

(ii) $m = 0.4$ to 0.48

Q112 (a) $-5.04, 1.75, 0$

(b) Correct graph

(c) -1.6 to -1.5 ; -0.4 to -0.3 and 1.8 to 1.9

(d) -2.6 to -2.5 ; -0.4 to -0.3 ; 1

(e) 3.25 to 4.25 with correct tangent

Q107 (a) (i) 8 (ii) 4 (b) 4 or -4

(c) $2x^2 + 7x - 11 = 0 \Rightarrow x = -4.68, 1.18$

(d) $\frac{x+2}{5}$ (e) -2

Q113 (a) (i) 1.4 to 1.6 (ii) 1.15 to 1.25

(iii) -1 (iv) -2.25 to -2.1 , -0.9 to -0.75
and 2.2 to 2.35

(b) (i) -15 (ii) $\frac{1-x}{2}$ (iii) $-2, 2$

(iv) $\frac{1}{8}$

Q108 (a) $-3, 7.375, 8.875$

(b) correct curve

(c) (i) Int $k < 7$ or $k > 10$

(ii) 7, 8, 9 (d) $y = 15 + 2$ ruled

(e) Tangent ruled at $x = 1.5$

Grad 7 to 12

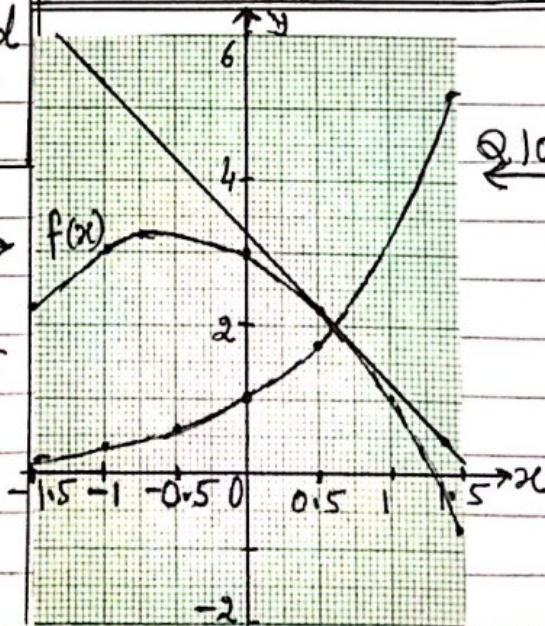
Q109 (a) 3, 0.33, 1

(b) correct quad. curve, correct exponential curve,

(c) (i) $1.2 < x < 1.4$ (ii) $1.2 < x < 1.35$

(iii) $0.55 < x < 0.7$

(d) $-2.5 < \text{grad} < -1.5$



Q109

Q114 (a) 7, 11.5, 4.5

Answers

(b) correct curve

(c) (i) $0.69 < x < 0.81$

(ii) $-2.3 < x < -2.2$; $-1.8 < x < -1.6$
and $0.35 < x < 0.5$

(d) (i) $y = 10 - 3x$ ruled

$-0.55 < x < -0.45$; $0.35 < x < 0.45$

(ii) 10, 1, -2

or -10, -1, 2

Q115 (a) (i) -6 (ii) 2.75

(b) $\frac{x-3}{4}$

(c) (i) 5

(ii) $x^2 + 5x - 7 = 0$

$x = 1.14$ and -6.14

