

**MHS Entrance Exam
Grade 12**

1. Reference: Math Stud II Chapter 1 Section 2

Consider the parabola whose equation is $y = 5(x - 3)^2 + 4$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The vertex of the parabola is at (3, 5).
2. The vertex of the parabola is at (-3, 4).
3. The vertex of the parabola is at (3, 4).
4. The axis of symmetry for the parabola is $x = 3$.
5. The axis of symmetry for the parabola is $y = 4$.

2. Reference: Math Stud II Chapter 1 Section 1

Question: If $g(x) = x^2 - 3x$, then $g(1+x) = x^2 - bx - c$, where b and c are constants to be determined. What is the value of b ?

3. Reference: Math Stud II Chapter 1 Section 1

If $g(x) = 4x + 5$ and $f(x) = \frac{x+2}{3x-2}$, then $(g \circ f)(x) = \frac{19x-B}{Cx+D}$, where B , C , and D are constants to be determined.

Give only the value of B for your answer.

4. Reference: Math Stud II Chapter 1 Section 1

Question: What is the value of $fg(20)$ if $f(x) = 4x - 3$ and $g(x) = \frac{1}{4}(x + 4)$?

5. Reference: Math Stud II Chapter 1 Section 1

Given $f(x) = (6x - 2)$ and $g(x) = \frac{1}{6}(x + 5)$. For what value of x is $fg(x) = 11$?

6. Reference: Math Stud II Chapter 1 Section 2

Consider the parabola whose equation is $y = 9x^2 + 1$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The vertex of the parabola is at (1, 0).
2. The vertex of the parabola is at (0, 1).
3. The vertex of the parabola is at (0, 9).
4. The axis of symmetry for the parabola is $y = 9$.
5. The axis of symmetry for the parabola is $x = 0$.

7. Reference: Math Stud II Chapter 1 Section 2

Consider the parabola whose equation is $y = x^2 + 10x - 5$.

Which of the following is true?

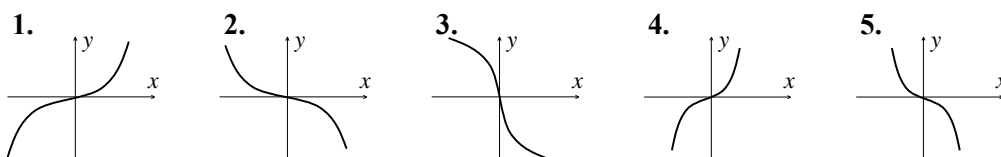
Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The axis of symmetry for the parabola is $x = -5$.
2. The axis of symmetry for the parabola is $x = 5$.
3. The vertex of the parabola is at $(-5, -30)$.
4. The vertex of the parabola is at $(5, -30)$.
5. The vertex of the parabola is at $(5, 30)$.

8. Reference: Math Stud II Chapter 1 Section 2

Which of the following could be the graph of $y = x^3$?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.



9. Reference: Level L Algebra 4 Chapter 2 Section 1

The solutions of $4x^2 - 6x + 1 = 0$ are $x = \frac{3 \pm \sqrt{a}}{4}$. What is the value of a ?

10. Reference: Level L Algebra 4 Chapter 2 Section 1

The equation $x^2 - 16x + 64 = 0$ has one solution only.
What is the value of this solution?

11. Reference: Level L Algebra 4 Chapter 2 Section 2

The roots of $3x^2 + bx + c = 0$ are 4 and 5. What is the value of c ?

12. Reference: Level L Algebra 4 Chapter 2 Section 2

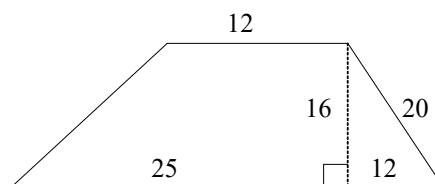
What is the sum of the roots of the equation $3x^2 - 9x - 5 = 0$?

13. Reference: Math Stud II Chapter 5 Section 1

What is the area of a triangle with base 17 and corresponding height 22?

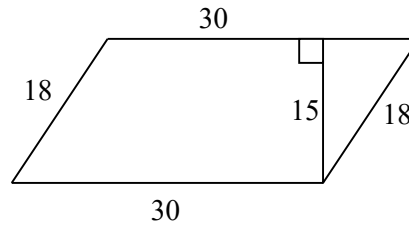
14. Reference: Math Stud II Chapter 5 Section 1

What is the area of the trapezoid drawn below?



15. Reference: Math Stud II Chapter 5 Section 1

What is the area of the parallelogram shown below?



16. Reference: Math Stud II Chapter 5 Section 1

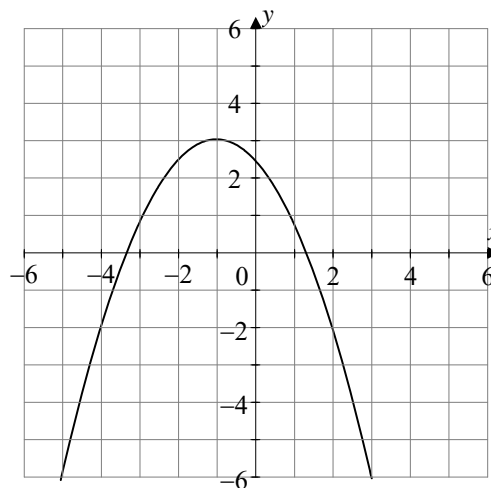
The area of a rectangle is 100 and its length is 20. What is the perimeter of this rectangle?

17. Reference: Math Stud II Chapter 6 Section 1

What is the value of b if $\begin{pmatrix} 2 & 3 \\ 5 & 2 \end{pmatrix} + 2\begin{pmatrix} -3 & 4 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$?

18. Reference: Level L Algebra 4 Chapter 4 Section 1

Consider the quadratic function $y = f(x) = a(x - b)^2 + c$ whose graph is shown below.



Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order). Enter the labels without any spaces or commas.

1. $a < 0$
2. $a > 0$
3. $b = 1$

4. $b = -1$

5. $c = -1$

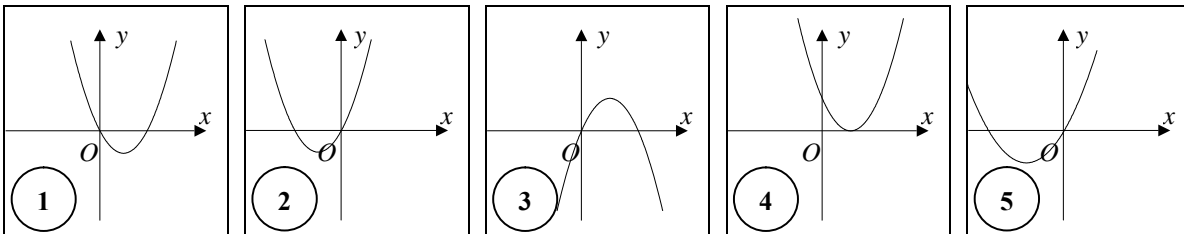
6. $c = 3$

19. Reference: Level L Algebra 4 Chapter 4 Section 1

Consider the quadratic function $y = f(x) = x^2 + 9x$.

Which of the graphs below could be the graph of the given function?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.



20. Reference: Level L Algebra 4 Chapter 6 Section 1

The canonical form of $y = 7x^2 - 42x + 52$ is $y = a(x + b)^2 + c$. What is the value of c ?

21. Reference: Level L Algebra 4 Chapter 8 Section 2

What is the magnitude of the position vector whose terminal point is at $(-7, 2\sqrt{30})$?

22. Reference: Level L Algebra 4 Chapter 8 Section 2

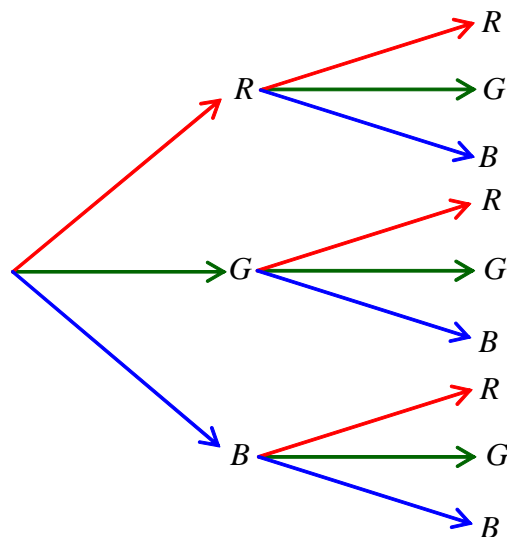
What is the x -coordinate of the position vector \overrightarrow{CB} if $C(-7, -3)$ and $B(9, -4)$?

23. Reference: Math Stud II Chapter 9 Section 1

A bag contains 15 red marbles, 12 green marbles, and 8 white marbles. A marble is picked at random from the bag. The probability the marble is red or green is $\frac{k}{35}$, where k is a number to be determined. What is the value of k ?

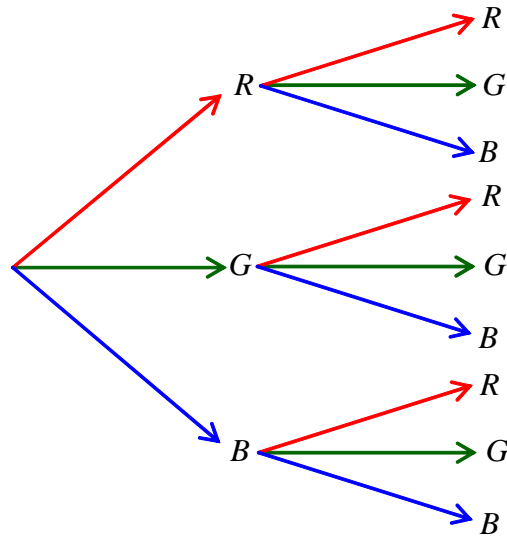
24. Reference: Math Stud II Chapter 9 Section 2

A bag contains 9 red marbles, 6 green marbles, and 5 blue marbles. Two marbles are selected at random without replacement. The probability both marbles are of the same color is $\frac{k}{380}$, where k is a number to be determined. What is the value of k ?



25. Reference: Math Stud II Chapter 9 Section 2

A bag contains 9 red marbles, 6 green marbles, and 5 blue marbles. Two marbles are selected at random. The probability both marbles are of different colors is $\frac{k}{380}$, where k is a number to be determined. What is the value of k ?



26. Reference: Math Stud II Chapter 9 Section 2

A class consists of 14 boys and 16 girls. If three from the class are picked at random, the probability that all three are girls is $\frac{k}{29}$, where k is a number to be determined. What is the value of k ?

27. Reference: Math Stud II Chapter 10 Section 3

The table shows the number of bread rolls sold by a bakery to 40 of its customers on a particular day.

Number of bread rolls	8	7	6	5	3
Number of customers	9	8	13	7	3

What is the median number of bread rolls sold on that day per customer?

28. Reference: Math Stud II Chapter 10 Section 2

A set of numbers has an average of 24. If the number 42 is added to the set, the new average becomes 26. How many numbers were in the original set?

29. Reference: Math Stud II Chapter 10 Section 2

The heights of plants in a garden are given in the following table.

Height	Frequency
[5 – 15)	18
[15 – 25)	1
[25 – 35)	4
[35 – 45)	7

What is the average height of the plants?

30. Reference: Math Stud II Chapter 10 Section 3

What is the mode of: 9, 10, 10, 12, 21, 12, 10, 9 and 11?

31. Reference: Math Stud II Chapter 10 Section 3

A group of 30 married couples were surveyed. The table below shows the number of children different families have.

Number of children	Frequency
1	7
2	12
3	6
4	3
5	2

What is the mean number of children per family for the group in the survey?
 Write your answer with two decimal places.

32. Reference: Math Studies II Chapter 10 Section 3

The table shows a set of data grouped in intervals of different lengths.

Class	Frequency
[5 – 10)	6
[10 – 20)	11
[20 – 25)	10
[25 – 35)	9

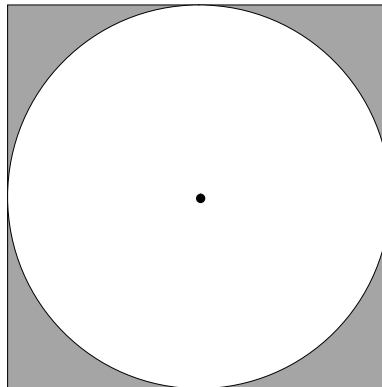
How many elements are there in the modal class?

33. Reference: Level L Geometry 3 Chapter 5 Section 3

The area of the circle whose circumference is 12π is $k\pi$, where k is a constant to be determined. What is the value of k ?

34. Reference: Level L Geometry 3 Chapter 5 Section 3

In the diagram below, the radius of the circle is 5.



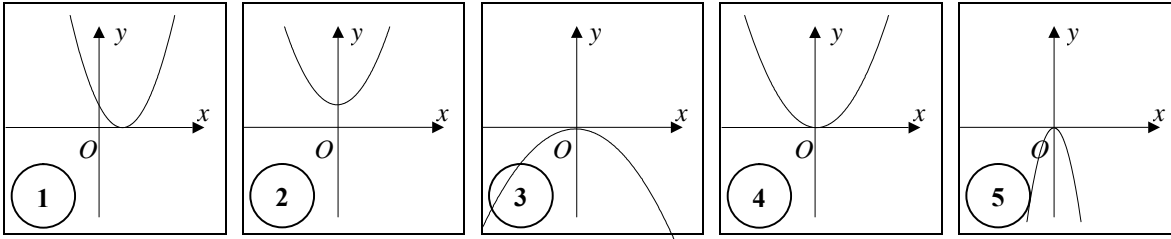
Using $\pi = \frac{22}{7}$, what is the area of the shaded region?

35. Reference: Level L Algebra 4 Chapter 4 Section 1

Consider the quadratic function $y = f(x) = -\frac{3}{2}x^2$.

Which of the graphs below could be the graph of the given function?

Select all that apply and enter their labels in the same order as they appear (ascending order). Enter the labels without any spaces or commas.



36. Reference: Level MS Pure Math Chapter 4 Section 3

Consider the curve C whose equation is given by $y = f(x) = \frac{1}{3}x^3 + 2x^2 - 77x + 95$.

If this curve has exactly one local maximum, give the x -coordinate of this local maximum. If it has no local maximum or more than one local maximum, enter 999 for your answer.

37. Reference: Level MS Pure Math Chapter 4 Section 5

Consider the function f given by $y = f(x) = 4x^3 + x^4$?

Which of the following is true about its graph?

Select all that apply and enter their labels in the same order as they appear (ascending order).

Enter the labels without any spaces or commas.

1. It is increasing on the interval $(-3, +\infty)$.
2. It is increasing on the interval $(0, +\infty)$ only.
3. It is decreasing on the interval $(-\infty, -3)$ and on the interval $(0, +\infty)$.
4. It is decreasing on the interval $(-\infty, -3)$.
5. It is increasing on the interval $(-\infty, -3)$ and on the interval $(0, +\infty)$.

38. Reference: Level MS Pure Math Chapter 3 Section 1

Given $f(x) = \frac{1}{x^2\sqrt{x}}$.

What whole number is equal to $f'(0.25)$?

39. Reference: Level MS Pure Math Chapter 3 Section 1

Given $f(x) = 4x^3 - 9x^2 - 19x - 429$.

What whole number is equal to $f'(9)$?

40. Reference: Level MS Pure Math Chapter 3 Section 2

Given $f(x) = \frac{384}{x^4}$.

What whole number is equal to $f'(-2)$?

41. Reference: Level MS Pure Math Chapter 3 Section 2

Given $f(x) = (x^2 + 4x)^4$.

What whole number is equal to $f'(1)$?

42. Reference: Math Stud II Chapter 1 Section 1

Consider the function f given by $f(x) = -\sqrt{-x}$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).

Enter the labels without any spaces or commas.

1. The domain of f is all real values of x greater than 0.
2. The domain of f is all real values of x less than or equal to 0.
3. The domain of f is all real values of x .
4. The domain of f is the same as the domain of $y = \frac{1}{\sqrt{-x}}$.

5. The domain of f is the same as the domain of $y = \sqrt{-x}$.

43. Reference: Math Stud II Chapter 5 Section 1

The area of a square is 196. What is the perimeter of this square?

44. Reference: Math Stud II Chapter 5 Section 2

Given a right circular cylinder with height 12 and volume 300. Its lateral area is $k\sqrt{\pi}$, where k is a constant to be determined.

What is the value of k ?

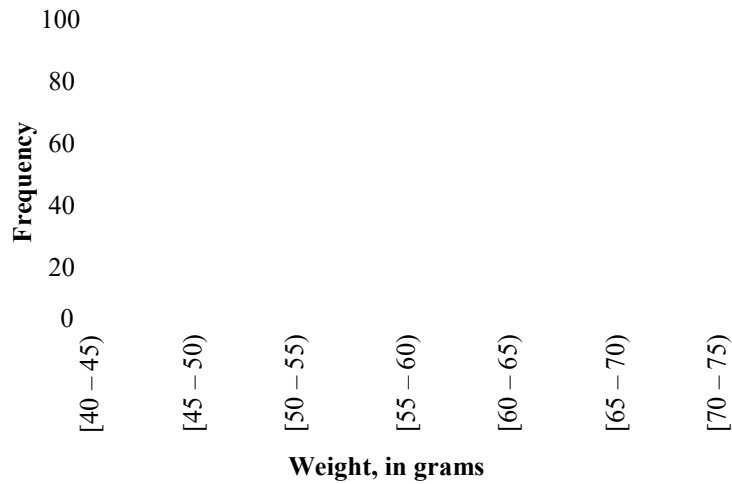
45. Reference: Math Stud II Chapter 9 Section 2

A bag contains 13 white marbles and 7 black marbles. A marble is picked at random from the bag. Its color is observed and then it is returned to the bag. Another marble is also picked from the bag

and also at random. The probability both marbles are black is $\frac{k}{400}$, where k is a number to be determined. What is the value of k ?

46. Reference: Math Stud II Chapter 10 Section 1

The weights of 100 apples are grouped in groups of fives and the cumulative frequency curve for the data collected is shown below.



How many apples are there in the [70 – 75) group?

Sample Questions Exam Answer Key

1. Reference: Math Stud II Chapter 1 Section 2

Consider the parabola whose equation is $y = 5(x - 3)^2 + 4$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The vertex of the parabola is at (3, 5).

2. The vertex of the parabola is at $(-3, 4)$.
3. The vertex of the parabola is at $(3, 4)$.
4. The axis of symmetry for the parabola is $x = 3$.
5. The axis of symmetry for the parabola is $y = 4$.

Sample question answer:

[Section 1]

34

2. Reference: Math Stud II Chapter 1 Section 1

Question: If $g(x) = x^2 - 3x$, then $g(1+x) = x^2 - bx - c$, where b and c are constants to be determined. What is the value of b ?

Sample question answer:

[Section 1]

$$g(1+x) = (1+x)^2 - 3(1+x) = 1 + 2x + x^2 - 3 - 3x = x^2 - x - 2.$$

Answer: 1

3. Reference: Math Stud II Chapter 1 Section 1

If $g(x) = 4x + 5$ and $f(x) = \frac{x+2}{3x-2}$, then $(g \circ f)(x) = \frac{19x-B}{Cx+D}$, where B , C , and D are constants to be determined.

Give only the value of B for your answer.

Sample question answer:

[Section 1]

$$(g \circ f)(x) = 4\left(\frac{x+2}{3x-2}\right) + 5 = \frac{4x+8}{3x-2} + 5 = \frac{4x+8+15x-10}{3x-2} = \frac{19x-2}{3x-2}$$

Answer: 2

4. Reference: Math Stud II Chapter 1 Section 1

Question: What is the value of $fg(20)$ if $f(x) = 4x - 3$ and $g(x) = \frac{1}{4}(x + 4)$?

Sample question answer:

[Section 1]

$$fg(x) = 4\left(\frac{1}{4}(x + 4)\right) - 3 = x + 4 - 3 = x + 1$$

$$fg(20) = 20 + 1 = 21.$$

Answer: 21

5. Reference: Math Stud II Chapter 1 Section 1

Given $f(x) = (6x - 2)$ and $g(x) = \frac{1}{6}(x + 5)$. For what value of x is $fg(x) = 11$?

Sample question answer:

[Section 1]

$$fg(x) = 6\left(\frac{1}{6}(x + 5)\right) - 2 = x + 3, \text{ if } fg(x) = 11, x + 3 = 11 \Rightarrow x = 8.$$

Answer: 8

6. Reference: Math Stud II Chapter 1 Section 2

Consider the parabola whose equation is $y = 9x^2 + 1$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The vertex of the parabola is at (1, 0).
2. The vertex of the parabola is at (0, 1).
3. The vertex of the parabola is at (0, 9).
4. The axis of symmetry for the parabola is $y = 9$.
5. The axis of symmetry for the parabola is $x = 0$.

Sample question answer:

[Section 1]
25

7. Reference: Math Stud II Chapter 1 Section 2

Consider the parabola whose equation is $y = x^2 + 10x - 5$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The axis of symmetry for the parabola is $x = -5$.
2. The axis of symmetry for the parabola is $x = 5$.
3. The vertex of the parabola is at $(-5, -30)$.
4. The vertex of the parabola is at $(5, -30)$.
5. The vertex of the parabola is at $(5, 30)$.

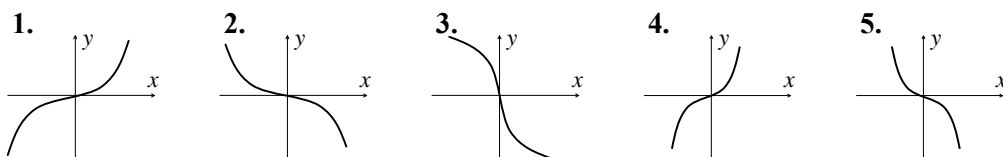
Sample question answer:

[Section 1]
13

8. Reference: Math Stud II Chapter 1 Section 2

Which of the following could be the graph of $y = x^3$?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.



Sample question answer:

[Section 1]
14

9. Reference: Level L Algebra 4 Chapter 2 Section 1

The solutions of $4x^2 - 6x + 1 = 0$ are $x = \frac{3 \pm \sqrt{a}}{4}$. What is the value of a ?

Sample question answer:

[Section 1]

$$x = \frac{6 \pm \sqrt{6^2 - 4(4)(1)}}{2(4)} = \frac{2(3) \pm \sqrt{36 - 16}}{2(4)} = \frac{2(3) \pm 2\sqrt{9 - 4}}{2(4)}$$

$$= \frac{2(3) \pm 2\sqrt{5}}{2(4)} = \frac{3 \pm \sqrt{5}}{4}, \text{ so } a = 5$$

10. Reference: Level L Algebra 4 Chapter 2 Section 1

The equation $x^2 - 16x + 64 = 0$ has one solution only.
What is the value of this solution?

Sample question answer:

[Section 1]

$x^2 - 16x + 64 = 0 \Leftrightarrow x^2 - 2 \times 8x + 8^2 = 0 \Leftrightarrow (x - 8)^2 = 0$, so $x = 8$ is the unique solution of the given equation.

11. Reference: Level L Algebra 4 Chapter 2 Section 2

The roots of $3x^2 + bx + c = 0$ are 4 and 5. What is the value of c ?

Sample question answer:

[Section 1]

The product of the roots $x_1 x_2 = \frac{c}{a}$ gives $c = ax_1 x_2 = 3 \times 4 \times 5 = 60$.

Thus, $c = 60$.

12. Reference: Level L Algebra 4 Chapter 2 Section 2

What is the sum of the roots of the equation $3x^2 - 9x - 5 = 0$?

Sample question answer:

[Section 1]

The sum of the roots $x_1 + x_2 = -\frac{b}{a}$ gives $x_1 + x_2 = -\frac{-9}{3} = 3$.

Thus, the sum of the roots of the given equation is 3.

13. Reference: Math Stud II Chapter 5 Section 1

What is the area of a triangle with base 17 and corresponding height 22?

Sample question answer:

[Section 1]

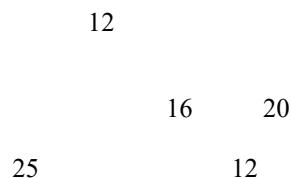
The area of the triangle is $\frac{1}{2} \times (\text{Length of the base}) \times (\text{Length of the corresponding height})$.

$$A = \frac{1}{2} \times 17 \times 22 = 187$$

Answer: 187

14. Reference: Math Stud II Chapter 5 Section 1

What is the area of the trapezoid drawn below?



Sample question answer:

[Section 1]

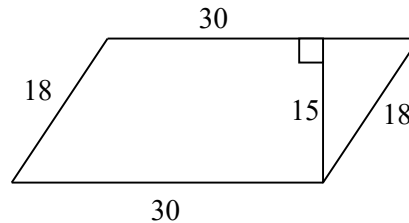
The area of a trapezoid is half the product of the height and the sum of the two bases. The length of the bases are 12 and 37 respectively, the height is 16.

$$A = \frac{16}{2} (12 + 37) = 392$$

Answer: 392

15. Reference: Math Stud II Chapter 5 Section 1

What is the area of the parallelogram shown below?



Sample question answer:

[Section 1]

The area of the parallelogram is: bh . $h = 15$ and $b = 30$, hence $A = 15 \times 30 = 450$.

Answer: 450

16. Reference: Math Stud II Chapter 5 Section 1

The area of a rectangle is 100 and its length is 20. What is the perimeter of this rectangle?

Sample question answer:

[Section 1]

$$\text{Area} = ab \Rightarrow 100 = 20 \times b \Rightarrow b = 5$$

The width of the rectangle is 5.

$$P = 2(a + b) \Rightarrow P = 2(20 + 5) \Rightarrow P = 50$$

Answer: 50

17. Reference: Math Stud II Chapter 6 Section 1

What is the value of b if $\begin{pmatrix} 2 & 3 \\ 5 & 2 \end{pmatrix} + 2\begin{pmatrix} -3 & 4 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$?

Sample question answer:

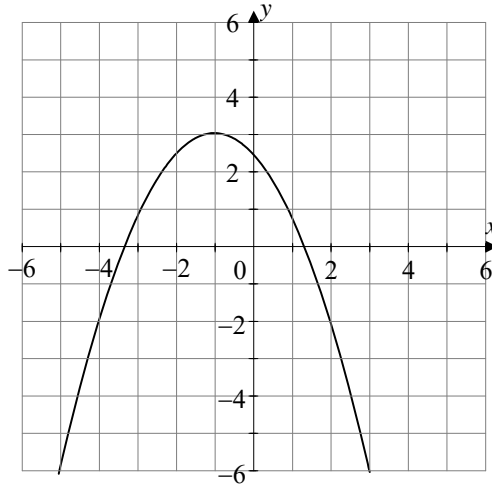
[Section 1]

$$b = 3 + 2 \times 4 = 11.$$

Answer: 11

18. Reference: Level L Algebra 4 Chapter 4 Section 1

Consider the quadratic function $y = f(x) = a(x - b)^2 + c$ whose graph is shown below.



Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. $a < 0$
2. $a > 0$
3. $b = 1$
4. $b = -1$
5. $c = -1$
6. $c = 3$

Sample question answer:

[Section 1]

The graph opens downwards, so $a < 0$.

The vertex is at $(-1, 3)$, so $b = -1$, and $c = 3$.

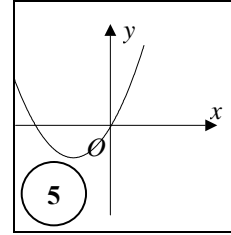
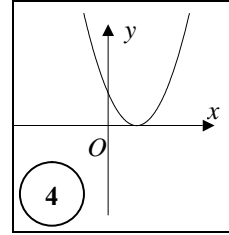
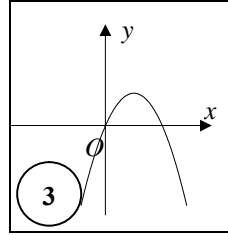
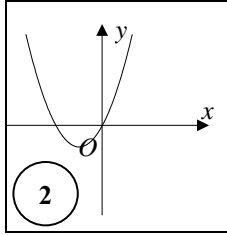
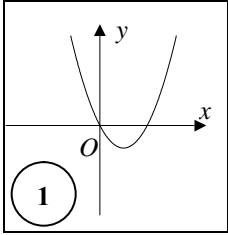
The answer is 146.

19. Reference: Level L Algebra 4 Chapter 4 Section 1

Consider the quadratic function $y = f(x) = x^2 + 9x$.

Which of the graphs below could be the graph of the given function?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.



Sample question answer:

[Section 1]

Compare the given equation with the standard form of a quadratic equation: $ax^2 + bx + c = 0$.Thus, $a = 1 > 0$, so the parabola opens upwards.

$$x = -\frac{b}{2a} = -\frac{9}{2} \text{ is the axis of symmetry.}$$

Therefore, the graphs 2 and 5 satisfy these conditions.

The answer is 25.

20. Reference: Level L Algebra 4 Chapter 6 Section 1The canonical form of $y = 7x^2 - 42x + 52$ is $y = a(x + b)^2 + c$. What is the value of c ?**Sample question answer:**

[Section 1]

$$7x^2 - 42x + 52 = 7(x^2 - 6x + 9) - 11 = 7(x^2 - 2 \times 3x + 3^2) - 7(3^2) + 52 = 7(x - 3)^2 - 11$$

Thus, $c = -11$.**21. Reference:** Level L Algebra 4 Chapter 8 Section 2What is the magnitude of the position vector whose terminal point is at $(-7, 2\sqrt{30})$?**Sample question answer:**

[Section 1]

The magnitude of the position vector is equal to the square root of the sum of squares of

differences of the coordinates of the endpoints:

$$\sqrt{(-7 - 0)^2 + (2\sqrt{30} - 0)^2} = \sqrt{49 + 4 \times 30} = \sqrt{49 + 120} = \sqrt{169} = 13.$$

Thus, the correct answer is 13.

22. Reference: Level L Algebra 4 Chapter 8 Section 2

What is the x -coordinate of the position vector \overrightarrow{CB} if $C(-7, -3)$ and $B(9, -4)$?

Sample question answer:**[Section 1]**

The x -coordinate of the position vector \overrightarrow{CB} is equal to $x_B - x_C = 9 - (-7) = 9 + 7 = 16$.

23. Reference: Math Stud II Chapter 9 Section 1

A bag contains 15 red marbles, 12 green marbles, and 8 white marbles. A marble is picked at random from the bag. The probability the marble is red or green is $\frac{k}{35}$, where k is a number to be determined. What is the value of k ?

Sample question answer:**[Section 1]**

There are 35 marbles in the bag.

The probability to pick red marble is $\frac{15}{35}$ and the probability to pick green marble is $\frac{12}{35}$.

The probability to pick red or green marble is $\frac{27}{35}$.

Answer: 27

24. Reference: Math Stud II Chapter 9 Section 2

The number of ways to choose two marbles is $20 \times 19 = 380$.

The number of ways to choose two red marbles is $9 \times 8 = 72$.

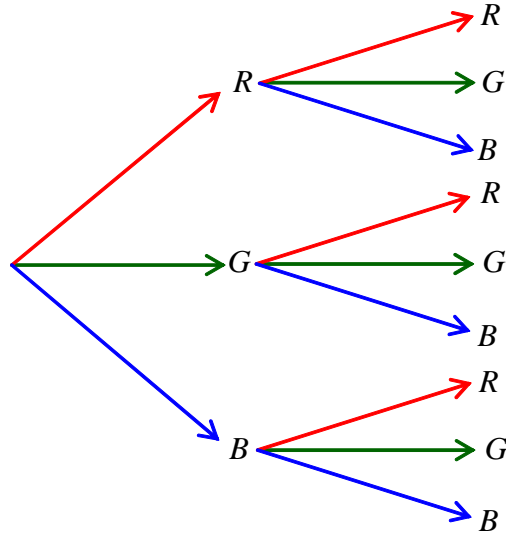
The number of ways to choose two green marbles is $6 \times 5 = 30$.

The number of ways to choose two blue marbles is $5 \times 4 = 20$.

$$P = \frac{72}{380} + \frac{30}{380} + \frac{20}{380} = \frac{122}{380}$$

Answer: 122

A bag contains 9 red marbles, 6 green marbles, and 5 blue marbles. Two marbles are selected at random without replacement. The probability both marbles are of the same color is $\frac{k}{380}$, where k is a number to be determined. What is the value of k ?



Sample question answer:

[Section 1]

The number of ways to choose two marbles is $20 \times 19 = 380$.

The number of ways to choose two red marbles is $9 \times 8 = 72$.

The number of ways to choose two green marbles is $6 \times 5 = 30$.

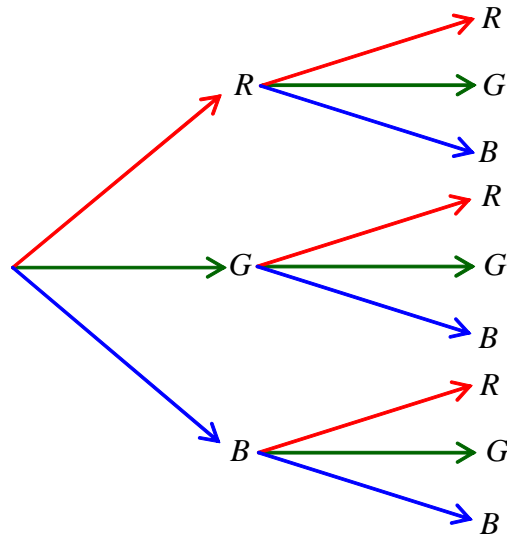
The number of ways to choose two blue marbles is $5 \times 4 = 20$.

$$P = \frac{72}{380} + \frac{30}{380} + \frac{20}{380} = \frac{122}{380}$$

Answer: 122

25. Reference: Math Stud II Chapter 9 Section 2

A bag contains 9 red marbles, 6 green marbles, and 5 blue marbles. Two marbles are selected at random. The probability both marbles are of different colors is $\frac{k}{380}$, where k is a number to be determined. What is the value of k ?



Sample question answer:

[Section 1]

The number of ways to choose two marbles is $20 \times 19 = 380$.

The number of ways to choose two red marbles is $9 \times 8 = 72$.

The number of ways to choose two green marbles is $6 \times 5 = 30$.

The number of ways to choose two blue marbles is $5 \times 4 = 20$.

The probability both marbles are the same color is $P = \frac{72}{380} + \frac{30}{380} + \frac{20}{380} = \frac{122}{380}$.

The event “the two balls selected have different colors” is the complement of the event “the two balls selected have the same color”.

Thus, $P(\text{Different colors.}) = 1 - \frac{122}{380} = \frac{258}{380}$.

Answer:258

26. Reference: Math Stud II Chapter 9 Section 2

A class consists of 14 boys and 16 girls. If three from the class are picked at random, the probability that all three are girls is $\frac{k}{29}$, where k is a number to be determined. What is the value of k ?

Sample question answer:

[Section 1]

There are $30 \times 29 \times 28 = 24,360$ ways to select three pupils.

$16 \times 15 \times 14 = 3,360$ ways corresponding to the event “all three are girls”.

$$P(ggg) = \frac{3,360}{24,360} = \frac{4}{29}$$

Answer: 4

27. Reference: Math Stud II Chapter 10 Section 3

The table shows the number of bread rolls sold by a bakery to 40 of its customers on a particular day.

Number of bread rolls	8	7	6	5	3
Number of customers	9	8	13	7	3

What is the median number of bread rolls sold on that day per customer?

Sample question answer:

[Section 1]

The total number of data items is 40. The average of 20th and 21th observation is the median.

The 20th observation up to 30th observation are all 6. Thus, the 20th and 21th observation are

both 6's, and the median is $\frac{6+6}{2} = 6$.

Answer: 6

28. Reference: Math Stud II Chapter 10 Section 2

A set of numbers has an average of 24. If the number 42 is added to the set, the new average becomes 26. How many numbers were in the original set?

Sample question answer:

[Section 1]

Let S_n be the sum of the original set, and n the number of numbers in original set.

$$\frac{S_n}{n} = 24 \Rightarrow S_n = 24n$$

The average of the new set is $\frac{S_n + 42}{n + 1} = 26$.

Substituting $S_n = 24n$ to the expression gives

$$\frac{24n + 42}{n + 1} = 26 \Rightarrow 24n + 42 = 26n + 26 \Rightarrow 2n = 16 \Rightarrow n = 8.$$

Answer: 8

29. Reference: Math Stud II Chapter 10 Section 2

The heights of plants in a garden are given in the following table.

Height	Frequency
[5 – 15)	18
[15 – 25)	1
[25 – 35)	4
[35 – 45)	7

What is the average height of the plants?

Sample question answer:
[Section 1]

Height	Mid value x_i	Frequency f_i	xf_i
[5 – 15)	10	18	180
[15 – 25)	20	1	20
[25 – 35)	30	4	120
[35 – 45)	40	7	280

$$\text{The mean height of the plants} = \frac{\sum f_i x_i}{\sum f_i} = \frac{600}{30} = 20.$$

Answer: 20

30. Reference: Math Stud II Chapter 10 Section 3

What is the mode of: 9, 10, 10, 12, 21, 12, 10, 9 and 11?

Sample question answer:

[Section 1]

The number 10 has a frequency of occurrence equal to 3. It is the highest frequency of occurrence of the number in a list of numbers. Hence, the mode of the data is 10.

Answer: 10

31. Reference: Math Stud II Chapter 10 Section 3

A group of 30 married couples were surveyed. The table below shows the number of children different families have.

Number of children	Frequency
1	7
2	12
3	6
4	3
5	2

What is the mean number of children per family for the group in the survey?
 Write your answer with two decimal places.

Sample question answer:

[Section 1]

The mean = $\frac{1 \times 7 + 2 \times 12 + 3 \times 6 + 4 \times 3 + 5 \times 2}{30} = \frac{71}{30} \approx 2.37$, to two decimal places.

Answer: 2.37

32. Reference: Math Studies II Chapter 10 Section 3

The table shows a set of data grouped in intervals of different lengths.

Class	Frequency
[5 – 10)	6
[10 – 20)	11
[20 – 25)	10
[25 – 35)	9

How many elements are there in the modal class?

Sample question answer:

[Section 1]

The class weight {5 – 10) is 5. The frequency is 6, thus its density is 1.2.

Similarly, the frequency density of [10 – 20), [20 – 25), [25 – 35) are, respectively, 1.1, 2, 0.9.

The class with the highest density is [20 – 25). Hence the modal class is [20 – 25). There are 10 elements.

Answer: 10

33. Reference: Level L Geometry 3 Chapter 5 Section 3

The area of the circle whose circumference is 12π is $k\pi$, where k is a constant to be determined. What is the value of k ?

Sample question answer:

[Section 1]

The circumference of the circle is $C = 2\pi r$.

Thus, $12\pi = 2\pi r$, which gives $r = 6$.

The area of the circle is $A = \pi r^2 = \pi \times 6^2 = 36\pi$.

Therefore, the value of k is 36.

34. Reference: Level L Geometry 3 Chapter 5 Section 3

In the diagram below, the radius of the circle is 5.

O

Using $\pi = \frac{22}{7}$, what is the area of the shaded region?

Sample question answer:

[Section 1]

The area of the square is $S_1 = 10^2 = 100$.

The area of the circle is $S_2 = \pi \times 5^2 = \frac{22}{7} \times 25 = \frac{550}{7}$

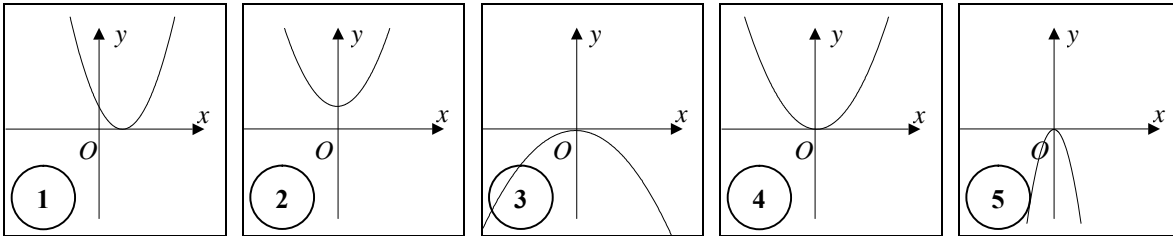
The area of the shaded region is $S = S_1 - S_2 = 100 - \frac{550}{7} = \frac{150}{7} = 21\frac{3}{7}$.

35. Reference: Level L Algebra 4 Chapter 4 Section 1

Consider the quadratic function $y = f(x) = -\frac{3}{2}x^2$.

Which of the graphs below could be the graph of the given function?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.



Sample question answer:

[Section 1]

Compare the given equation with the standard form of quadratic equation: $ax^2 + bx + c = 0$.

Thus, $a < 0$ and the parabola opens downwards; $b = 0$ and $c = 0$, so its vertex is at the origin.

Therefore, only graphs 3 and 5 satisfy these conditions.

The answer is 35.

36. Reference: Level MS Pure Math Chapter 4 Section 3

Consider the curve C whose equation is given by $y = f(x) = \frac{1}{3}x^3 + 2x^2 - 77x + 95$.

If this curve has exactly one local maximum, give the x -coordinate of this local maximum. If it has no local maximum or more than one local maximum, enter 999 for your answer.

Sample question answer:

[Section 1]

$$f'(x) = x^2 + 4x - 77 = (x + 11)(x - 7) = 0 \text{ for } x = -11 \text{ or } x = 7.$$

$$f''(x) = 2x + 4, \quad f''(-11) < 0, \text{ so } x = -11 \text{ is a local maximum of the function } f.$$

Answer: -11

37. Reference: Level MS Pure Math Chapter 4 Section 5

Consider the function f given by $y = f(x) = 4x^3 + x^4$?

Which of the following is true about its graph?

Select all that apply and enter their labels in the same order as they appear (ascending order).

Enter the labels without any spaces or commas.

1. It is increasing on the interval $(-3, +\infty)$.
2. It is increasing on the interval $(0, +\infty)$ only.
3. It is decreasing on the interval $(-\infty, -3)$ and on the interval $(0, +\infty)$.
4. It is decreasing on the interval $(-\infty, -3)$.
5. It is increasing on the interval $(-\infty, -3)$ and on the interval $(0, +\infty)$.

Sample question answer:

[Section 1]

$$f'(x) = 12x^2 + 4x^3 = 4x^2(3 + x) = 0 \text{ for } x = 0 \text{ or } x = -3.$$

Then $f'(x) > 0$ for $x > -3$ and $f'(x) < 0$ for $x < -3$ which means that the function f is decreasing on the interval $(-\infty, -3)$ and increasing on the interval $(-3, +\infty)$.

Hence, the answer is 14.

38. Reference: Level MS Pure Math Chapter 3 Section 1

Given $f(x) = \frac{1}{x^2\sqrt{x}}$.

What whole number is equal to $f'(0.25)$?

Sample question answer:

[Section 1]

$$f'(x) = -\frac{5}{2x^{7/2}}, \quad f'(0.25) = -\frac{5}{2 \cdot 0.25^{7/2}} = -\frac{5 \cdot 2^7}{2} = -5 \cdot 64 = -320$$

39. Reference: Level MS Pure Math Chapter 3 Section 1

Given $f(x) = 4x^3 - 9x^2 - 19x - 429$.

What whole number is equal to $f'(9)$?

Sample question answer:

[Section 1]

$$f'(x) = 12x^2 - 18x - 19, \quad f'(9) = 12(81) - 18(9) - 19 = 791.$$

40. Reference: Level MS Pure Math Chapter 3 Section 2

Given $f(x) = \frac{384}{x^4}$.

What whole number is equal to $f'(-2)$?

Sample question answer:

[Section 1]

$$f'(x) = -\frac{1536}{x^5}, \quad f'(-2) = -\frac{1536}{-32} = 48.$$

41. Reference: Level MS Pure Math Chapter 3 Section 2

Given $f(x) = (x^2 + 4x)^4$.

What whole number is equal to $f'(1)$?

Sample question answer:

[Section 1]

$$f'(x) = 4(x^2 + 4x)^3(2x + 4), \quad f'(1) = 4(5)^3 \cdot 6 = 3,000.$$

Answer: 3,000

42. Reference: Math Stud II Chapter 1 Section 1

Consider the function f given by $f(x) = -\sqrt{-x}$.

Which of the following is true?

Select all that apply and enter their labels in the same order as they appear (ascending order).
Enter the labels without any spaces or commas.

1. The domain of f is all real values of x greater than 0.
2. The domain of f is all real values of x less than or equal to 0.
3. The domain of f is all real values of x .
4. The domain of f is the same as the domain of $y = \frac{1}{\sqrt{-x}}$.
5. The domain of f is the same as the domain of $y = \sqrt{-x}$.

Sample question answer:

[Section 1]

25

43. Reference: Math Stud II Chapter 5 Section 1

The area of a square is 196. What is the perimeter of this square?

Sample question answer:

[Section 1]

A square is a rectangle with all sides having the same length.

$$A = s^2 \Rightarrow s = \sqrt{A} \Rightarrow s = \sqrt{196} \Rightarrow s = 14$$

$$P = 4s \Rightarrow P = 4 \times 14 \Rightarrow P = 56$$

Answer: 56

44. Reference: Math Stud II Chapter 5 Section 2

Given a right circular cylinder with height 12 and volume 300. Its lateral area is $k\sqrt{\pi}$, where k is a constant to be determined.

What is the value of k ?

Sample question answer:**[Section 1]**

$$V = \pi r^2 h \Rightarrow r^2 = \frac{V}{\pi h} \Rightarrow r = \sqrt{\frac{V}{\pi h}} \Rightarrow r = \sqrt{\frac{300}{12\pi}} \Rightarrow r = \frac{5\sqrt{\pi}}{\pi}$$

$$LA = 2\pi r h \Rightarrow LA = 2 \times 12 \times \pi \times \frac{5\sqrt{\pi}}{\pi} = 120\sqrt{\pi}.$$

Answer: 120**45. Reference:** Math Stud II Chapter 9 Section 2

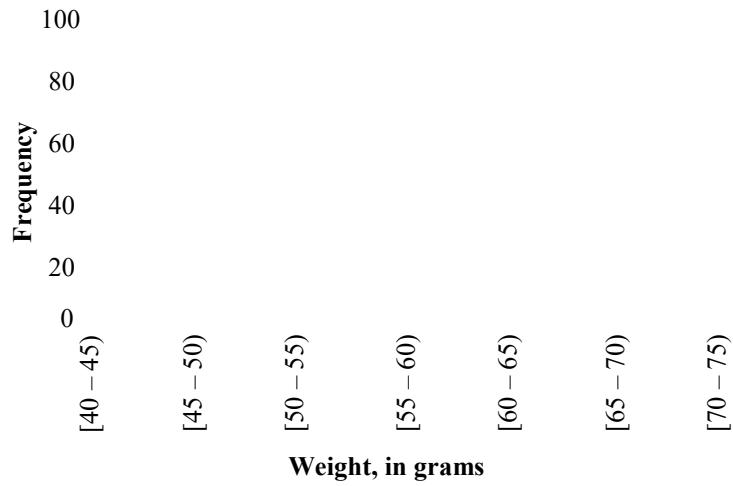
A bag contains 13 white marbles and 7 black marbles. A marble is picked at random from the bag. Its color is observed and then it is returned to the bag. Another marble is also picked from the bag and also at random. The probability both marbles are black is $\frac{k}{400}$, where k is a number to be determined. What is the value of k ?

Sample question answer:**[Section 1]****Having replaced the first marble, the outcome on the second draw is independent of the first**

one. The probability both marbles are black is $P = \frac{7}{20} \times \frac{7}{20} = \frac{49}{400}$.

Answer: 49**46. Reference:** Math Stud II Chapter 10 Section 1

The weights of 100 apples are grouped in groups of fives and the cumulative frequency curve for the data collected is shown below.



How many apples are there in the [70 – 75) group?

Sample question answer:

[Section 1]

100 – 60 = 40.

Answer: 40