Class 9 Maths Ganita Manjari Chapter 2 Exercise Set 2.1 Solutions

Exercise Set 2.1

1. Find the degrees of the following polynomials:

(i) $2x^2 - 5x + 3$
(ii) $y^3 + 2y - 1$
(iii) -9
(iv) $4z - 3$

Answer:
Degree of a polynomial is the highest power of the variable.
(i) $2x^2 - 5x + 3$
Highest power of x = 2
∴ Degree = 2

(ii) $y^3 + 2y - 1$
Highest power of y = 3
∴ Degree = 3

(iii) -9
This is a constant polynomial (no variable)
∴ Degree = 0

(iv) $4z - 3$
Highest power of z = 1
∴ Degree = 1

2. Write polynomials of degrees 1, 2 and 3.

Answer:
A polynomial of degree 1 (linear polynomial):
Example: $2x + 5$
A polynomial of degree 2 (quadratic polynomial):
Example: $x^2 + 3x + 1$
A polynomial of degree 3 (cubic polynomial):
Example: $x^3 - 2x^2 + x + 4$

3. What are the coefficients of x^2 and x^3 in the polynomial $x^4 - 3x^3 + 6x^2 - 2x + 7$?

Answer:
Given polynomial: $x^4 - 3x^3 + 6x^2 - 2x + 7$
Coefficient of $x^3 = -3$
Coefficient of $x^2 = 6$

4. What is the coefficient of z in the polynomial $4z^3 + 5z^2 - 11$?

Answer:
The given polynomial is $4z^3 + 5z^2 - 11$.
There is no term containing z^1 (i.e., z).
Hence, the coefficient of z is 0.

5. What is the constant term of the polynomial $9x^3 + 5x^2 - 8x - 10$?

Recall that polynomials of degree 1 are called linear polynomials. In this chapter, we shall study linear polynomials.

Answer:
The constant term is the term without any variable.
In the polynomial $9x^3 + 5x^2 - 8x - 10$, the constant term is -10.

Class 9 Maths Ganita Manjari Chapter 2 Exercise Set 2.2 Solutions

Exercise Set 2.2

1. Find the value of the linear polynomial 5x − 3 if:

(i) x = 0
(ii) x = −1
(iii) x = 2

Answer:
Given polynomial: 5x − 3
(i) x = 0
= 5(0) − 3 = −3

(ii) x = −1
= 5(−1) − 3 = −5 − 3 = −8

(iii) x = 2
= 5(2) − 3 = 10 − 3 = 7

2. Find the value of the quadratic polynomial $7s^2 - 4s + 6$ if:

(i) s = 0
(ii) s = −3
(iii) s = 4

Answer:
(i) For s = 0
$7s^2 - 4s + 6$
$= 7(0)^2 - 4(0) + 6 = 6$

(ii) For s = −3
$7s^2 - 4s + 6$
$= 7(-3)^2 - 4(-3) + 6$
$= 7(9) + 12 + 6$
$= 63 + 12 + 6 = 81$

(iii) For s = 4
$7s^2 - 4s + 6$
$= 7(4)^2 - 4(4) + 6$
$= 7(16) - 16 + 6$
$= 112 - 16 + 6 = 102$

3. The present age of Salil's mother is three times Salil's present age. After 5 years, their ages will add up to 70 years. Find their present ages.

Answer:
Let Salil's present age = x years
Mother's present age = 3x years

After 5 years:
Salil's age = x + 5
Mother's age = 3x + 5

According to question: (x + 5) + (3x + 5) = 70
⇒ 4x + 10 = 70
⇒ 4x = 60
⇒ x = 15
Therefore, Salil's age = 15 years
Mother's age = 45 years

4. The difference between two positive integers is 63. The ratio of the two integers is 2:5. Find the two integers.

Answer:
Let the integers be 2x and 5x
Difference: 5x − 2x = 63
⇒ 3x = 63
⇒ x = 21

Integers: 2x = 42
⇒ 5x = 105
Required integers are 42 and 105.

5. Ruby has 3 times as many two-rupee coins as she has five-rupee coins. If she has a total ₹88, how many coins does she have of each type?

Answer:
Let number of five-rupee coins = x
Number of two-rupee coins = 3x
Total value: 5x + 2(3x) = 88
⇒ 5x + 6x = 88
⇒ 11x = 88
⇒ x = 8
Hence:
Five-rupee coins = 8
Two-rupee coins = 24

6. A farmer cuts a 300 feet fence into two pieces of different sizes. The longer piece is four times as long as the shorter piece. How long are the two pieces?

Answer:
Let shorter piece = x feet
Longer piece = 4x feet

Total: x + 4x = 300
⇒ 5x = 300
⇒ x = 60

Therefore:
Shorter piece = 60 feet
Longer piece = 240 feet.

7. If the length of a rectangle is three more than twice its width and its perimeter is 24 cm, what are the dimensions of the rectangle?

Answer:

Let width = x cm

Length = 2x + 3 cm

Perimeter = 2(length + width)

$\Rightarrow 2[(2x + 3) + x] = 24$

$\Rightarrow 2(3x + 3) = 24$

$\Rightarrow 6x + 6 = 24$

$\Rightarrow 6x = 18$

$\Rightarrow x = 3$

Therefore:

Width = 3 cm

Length = 2(3) + 3 = 9 cm

Class 9 Maths Ganita Manjari Chapter 2 Exercise Set 2.3 Solutions

Exercise Set 2.3

1. A student has ₹500 in her savings bank account. She gets ₹150 every month as pocket money. How much money will she have at the end of every month from the second month onwards?

Find a linear expression to represent the amount she will have in the n^{th} month.

Answer:

Initial amount in bank = ₹500
Monthly pocket money = ₹150

At the end of:
2nd month = 500 + 2(150) = ₹800
3rd month = 500 + 3(150) = ₹950
4th month = 500 + 4(150) = ₹1100
and so on…

Let the amount in the n^{th} month be A_n
Then, $A_n = 500 + 150n$
Thus, the required linear expression is:
$A_n = 150n + 500$

2. A rally starts with 120 members. Each hour, 9 members drop out of the group. How many members will remain after 1, 2, 3, … hours? Find a linear expression to represent the number of members at the end of the n^{th} hour.

Answer:
Initial members = 120
Members leaving each hour = 9
After:
1 hour = 120 − 9 = 111
2 hours = 120 − 18 = 102
3 hours = 120 − 27 = 93
Let number of members after n hours = M_n
$M_n = 120 - 9n$
Thus, required linear expression is $M_n = 120 - 9n$.

3. Suppose the length of a rectangle is 13 cm. Find the area if the breadth is (i) 12 cm, (ii) 10 cm, (iii) 8 cm. Find the linear pattern representing the area of the rectangle.

Answer:
Length = 13 cm
Area = Length × Breadth

(i) Breadth = 12 cm
Area = 13 × 12 = 156 cm^2

(ii) Breadth = 10 cm
Area = 13 × 10 = 130 cm^2

(iii) Breadth = 8 cm
Area = 13 × 8 = 104 cm^2

Let breadth = x cm
Area = 13x
Thus, linear pattern is A = 13x.

4. Suppose the length of a rectangular box is 7 cm and breadth is 11 cm. Find the volume if the height is (i) 5 cm, (ii) 9 cm, (iii) 13 cm. Find the linear pattern representing the volume of the rectangular box.

Answer:
Length = 7 cm, Breadth = 11 cm
Volume = Length × Breadth × Height
= 7 × 11 × h = 77h

(i) Height = 5 cm
Volume = 77 × 5 = 385 cm^3

(ii) Height = 9 cm
Volume = 77 × 9 = 693 cm^3

(iii) Height = 13 cm
Volume = 77 × 13 = 1001 cm^3

Let height = h cm
Volume = 77h
Thus, linear pattern is V = 77h.

5. Sarita is reading a book of 500 pages. She reads 20 pages every day. How many pages will be left after 15 days? Express this as a linear pattern.

Answer:
Total pages = 500
Pages read per day = 20
Pages read in 15 days = 20 × 15 = 300
Pages left = 500 − 300 = 200
Let pages left after n days = P_n
So, $P_n = 500 - 20n$
Thus, linear pattern is $P_n = 500 - 20n$.

Class 9 Maths Ganita Manjari Chapter 2 Exercise Set 2.4 Solutions

Exercise Set 2.4

1. Suppose a plant has height 1.75 feet and it grows by 0.5 feet each month.

(i) Find the height after 7 months.
(ii) Make a table of values for t varying from 0 to 10 months and show how the height, h, increases every month.
(iii) Find an expression that relates h and t, and explain why it represents linear growth.

Answer:
Given:
Initial height = 1.75 feet
Growth per month = 0.5 feet

(i) Height growth in each month = 0.5 feet
So, Height after 7 months:
$h = 1.75 + (0.5 \times 7)$
$= 1.75 + 3.5$
$= 5.25$ feet

(ii) Table of values:

t (months)	h (feet)
0	1.75
1	2.25
2	2.75
3	3.25
4	3.75
5	4.25
6	4.75
7	5.25
8	5.75
9	6.25
10	6.75

(iii) Expression:
Let height after t months = h
$h = 1.75 + 0.5t$
This represents linear growth because height increases by a constant amount (0.5 feet) every month.

2. A mobile phone is bought for ₹10,000. Its value decreases by ₹800 every year.

(i) Find the value of the phone after 3 years.
(ii) Make a table of values for t varying from 0 to 8 years and show how the value of the phone, v, depreciates with time.
(iii) Find an expression that relates v and t, and explain why it represents linear decay.

Answer:
Given:
Initial value = ₹10,000
Decrease per year = ₹800

(i) Decrease in value after 1 year = ₹800
So, Value after 3 years:
$v = 10000 - (800 \times 3)$
$= 10000 - 2400$
$=$ ₹7600

(ii) Table of values:

t (years)	v (₹)
0	10000
1	9200
2	8400
3	7600
4	6800
5	6000
6	5200
7	4400
8	3600

(iii) Expression:
Let value after t years = v
$v = 10000 - 800t$
This represents linear decay because the value decreases by a constant amount (₹800) every year.

3. The initial population of a village is 750. Every year, 50 people move from a nearby city to the village.

(i) Find the population of the village after 6 years.
(ii) Make a table of values for t varying from 0 to 10 years and

show how the population, P, increases every year.
(iii) Find an expression that relates P and t, and explain why it represents linear growth.

Answer:
(i) Population after 6 years:
$P = 750 + (50 \times 6)$
$= 750 + 300$
$= 1050$

(ii) Table of values:

t (years)	**P (population)**
0	750
1	800
2	850
3	900
4	950
5	1000
6	1050
7	1100
8	1150
9	1200
10	1250

(iii) Expression:
Let population after t years = P
$P = 750 + 50t$
This represents linear growth because the population increases by a constant number (50 people) every year.

4. A telecom company charges ₹600 for a certain recharge scheme. This prepaid balance is reduced by ₹15 each day after recharge.

(i) Write an equation that models the remaining balance b(x) after using the scheme for x days. Explain why it represents linear decay.
(ii) After how many days will the balance run out?
(iii) Make a table of values for x varying from 1 to 10 days and show how the balance b(x) reduces with time.

Answer:
(i) Expression:
Let remaining balance after x days = b(x)
$b(x) = 600 - 15x$
This represents linear decay because the balance decreases by a constant amount (₹15) every day.

(ii) When balance runs out:
$b(x) = 0$
$600 - 15x = 0$
$15x = 600$
$x = 40$
So, the balance will run out after 40 days.

(iii) Table of values:

x (days)	**b(x) (₹)**
1	585
2	570
3	555
4	540
5	525
6	510
7	495
8	480
9	465
10	450

Class 9 Maths Ganita Manjari Chapter 2 Exercise Set 2.5 Solutions

Exercise Set 2.5

1. A learning platform charges a fixed monthly fee and an additional cost per digital learning module accessed. A student observed that when she accessed 10 modules, her bill was ₹400. When she accessed 14 modules, her bill was ₹500. If the monthly bill y depends on the number of modules accessed, x, according to the relation y = ax + b, find the values of a and b.

Answer:
Given:
When $x = 10$, $y = 400$
When $x = 14$, $y = 500$
Using $y = ax + b$
For $x = 10$: $400 = 10a + b$ …(1)
For $x = 14$: $500 = 14a + b$ …(2)
Subtracting (1) from (2), we get:
$500 - 400 = 14a - 10a$
$\Rightarrow 100 = 4a$
$\Rightarrow a = 25$
Substituting $a = 25$ in (1), we get:
$400 = 10(25) + b$

⇒ 400 = 250 + b
⇒ b = 150
Therefore, a = 25 and b = 150.

2. A gym charges a fixed monthly fee and an additional cost per hour for using the badminton court. A student using the gym observed that when she used the badminton court for 10 hours, her bill was ₹800. When she used it for 15 hours, her bill was ₹1100. If the monthly bill y depends on the hours of the use of the badminton court, x, according to the relation y = ax + b, find the values of a and b.

Answer:
Given:
When x = 10, y = 800
When x = 15, y = 1100
Using y = ax + b
For x = 10: 800 = 10a + b …(1)
For x = 15: 1100 = 15a + b …(2)
Subtracting (1) from (2), we have:
1100 − 800 = 15a − 10a
⇒ 300 = 5a
⇒ a = 60
Substitute a = 60 in (1), we get:
800 = 10(60) + b
⇒ 800 = 600 + b

⇒ b = 200
Therefore, a = 60 and b = 200.

3. Consider the relationship between temperature measured in degrees Celsius (°C) and degrees Fahrenheit (°F), which is given by °C = a°F + b. Find a and b, given that ice melts at 0 degrees Celsius and 32 degrees Fahrenheit, and water boils at 100 degrees Celsius and 212 degrees Fahrenheit.

(Hint: When °C = 0, °F = 32 and when °C = 100, °F = 212. Use this information to find a and b, and thus, the linear relationship between °C and °F.)

Answer:
Given relation: °C = a°F + b
Using the point (°F, °C) = (32, 0), we have:
$0 = 32a + b$ …(1)
Using the point (°F, °C) = (212, 100), we have:
$100 = 212a + b$ …(2)
Subtracting (1) from (2), we get:
$100 - 0 = 212a - 32a$
⇒ $100 = 180a$
⇒ $a = 100/180$
⇒ $a = 5/9$
Substitute a = 5/9 in (1), we get:
$0 = 32(5/9) + b$
⇒ $0 = 160/9 + b$

⇒ b = −160/9
Therefore, a = 5/9 and b = −160/9.
Hence, the linear relationship is °C = (5/9)°F − 160/9.
It can also be written as °C = (5/9)(°F − 32).

Class 9 Maths Ganita Manjari Chapter 2 Exercise Set 2.6 Solutions

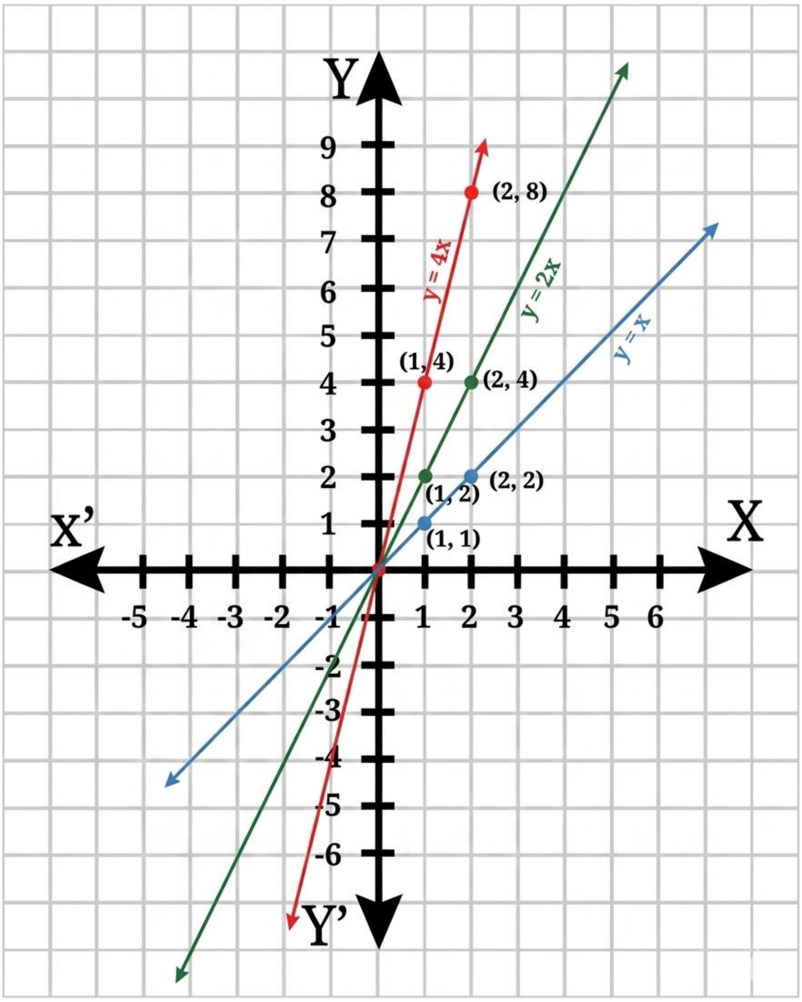
Exercise Set 2.6

1. Draw the graphs of the following sets of lines. In each case, reflect on the role of 'a' and 'b'.

(i) $y = 4x$, $y = 2x$, $y = x$

Answer:
All lines are of the form $y = ax$ ($b = 0$).
Observation:

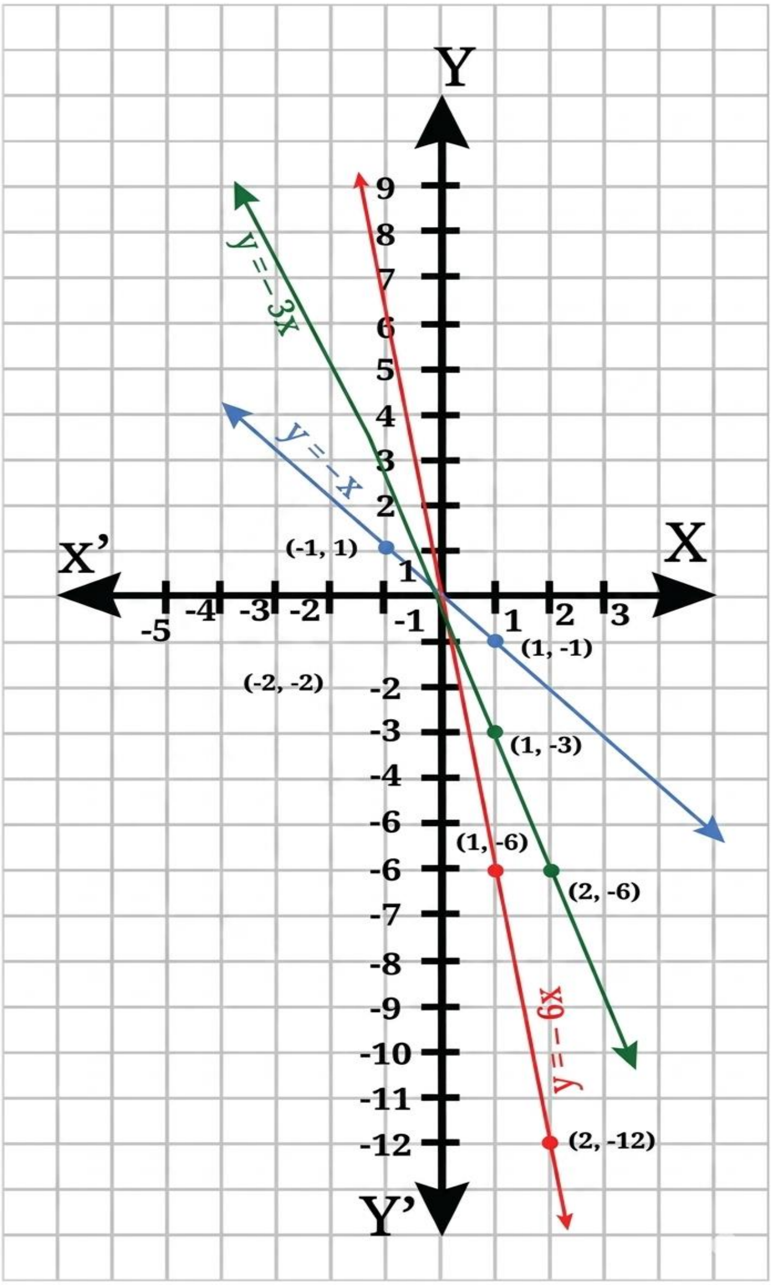
- All lines pass through the origin (0,0).
- The value of 'a' (slope) determines steepness.
- Larger 'a' → steeper line.



(ii) $y = -6x$, $y = -3x$, $y = -x$

Answer:
All lines are of the form $y = ax$ ($b = 0$).
Observation:

- All lines pass through the origin.
- Negative 'a' means lines slope downward.
- Larger magnitude of 'a' → steeper downward slope.

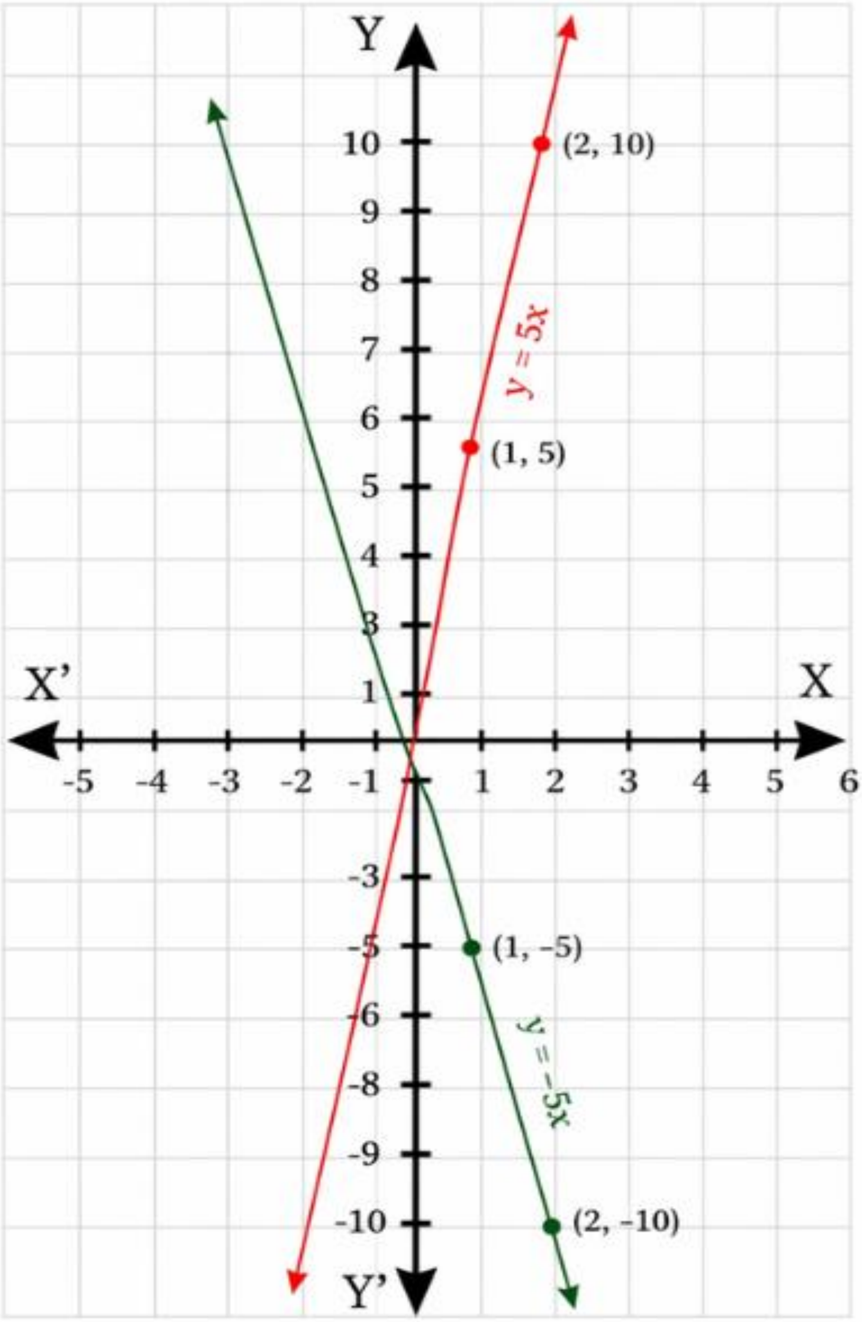


(iii) $y = 5x$, $y = -5x$

Answer:

Observation:

- Both lines pass through the origin.
- $y = 5x$ slopes upward, $y = -5x$ slopes downward.
- Same magnitude of ‘a’ → same steepness but opposite direction.

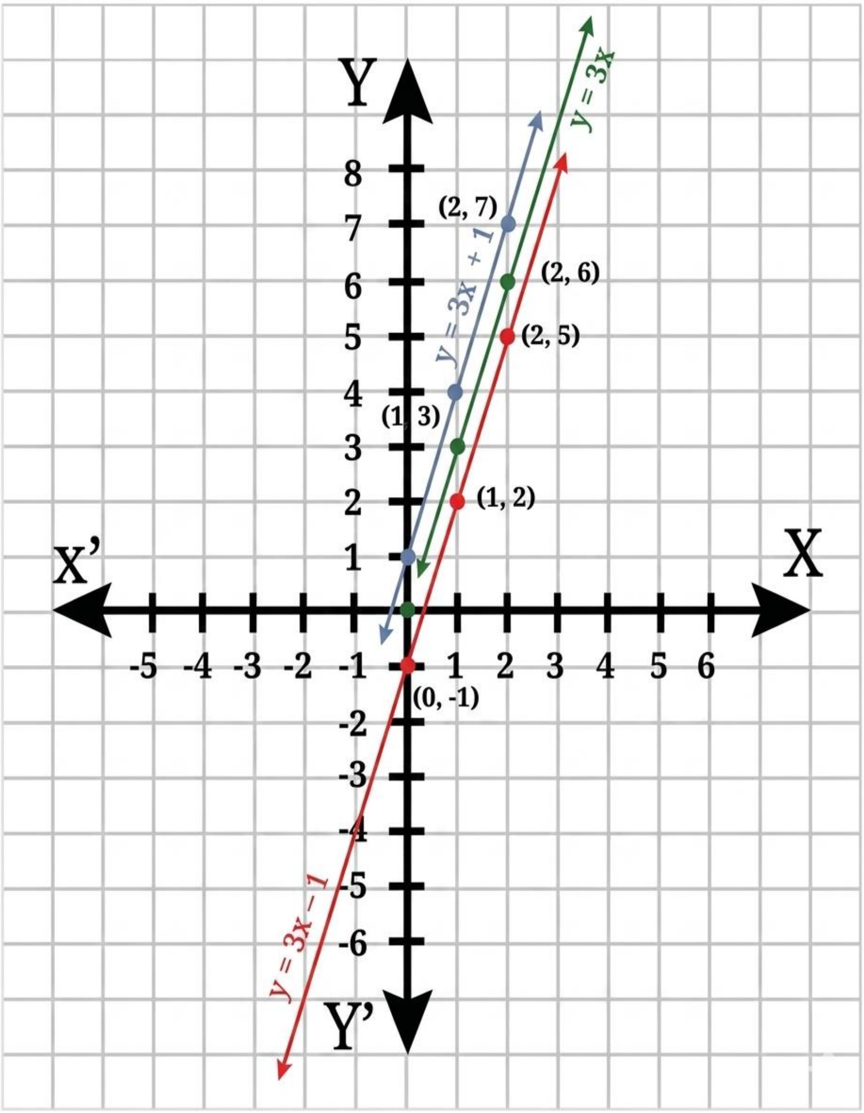


(iv) y = 3x − 1, y = 3x, y = 3x + 1

Answer:
All lines have same slope (a = 3).
Observation:

- Lines are parallel (same slope).

- Different values of ‘b’ shift the line up or down.
- b = −1 → line below origin
- b = 0 → passes through origin
- b = +1 → line above origin.



(v) y = −2x − 3, y = −2x, y = 2x + 3

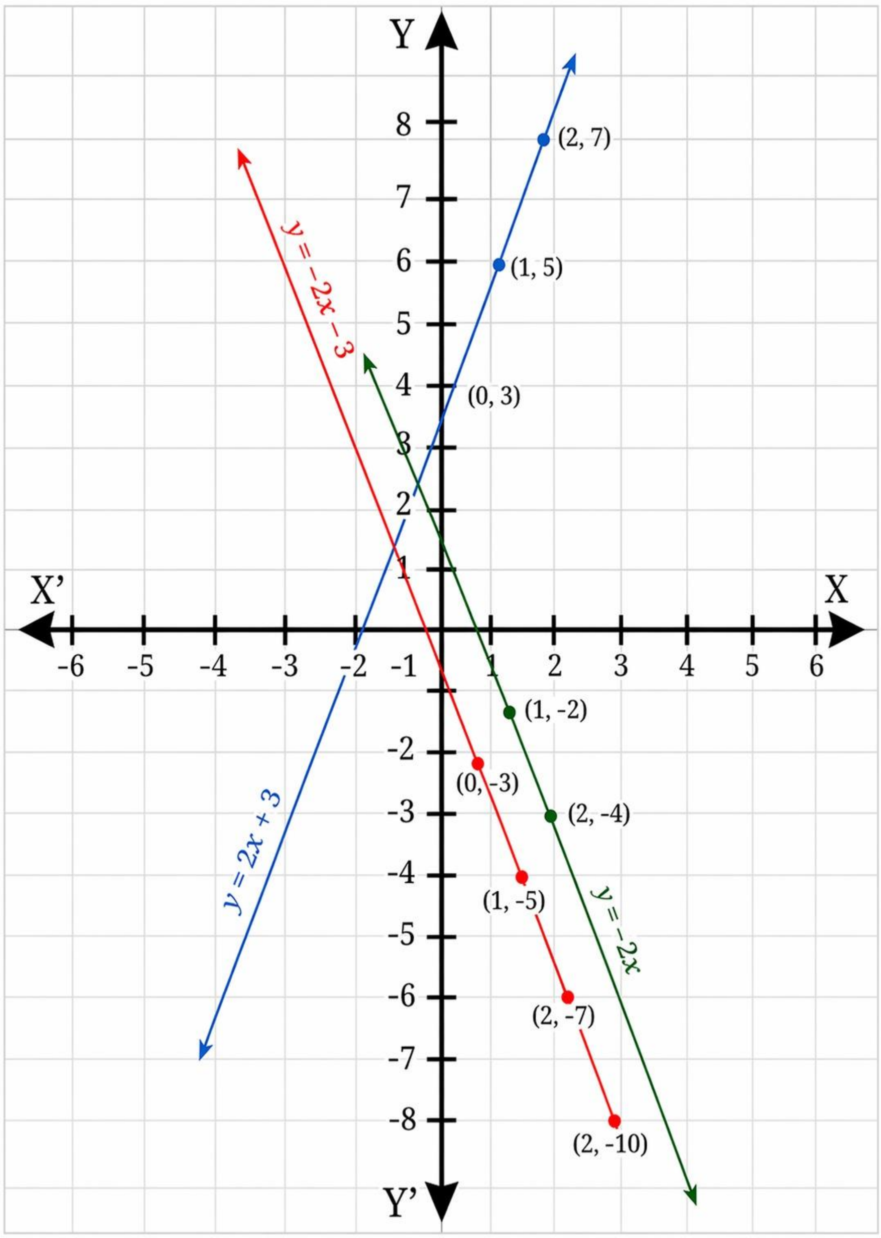
Answer:
Observation:

- y = −2x − 3 and y = −2x have same slope (−2) → parallel lines.

- y = 2x + 3 has positive slope → different direction.
- ‘b’ changes vertical position of line.

Conclusion:

1. ‘a’ (coefficient of x) controls slope (steepness and direction).
2. ‘b’ (constant term) controls vertical shift (y-intercept).



Class 9 Maths Ganita Manjari Chapter 2 End of Chapter Exercises Solutions

End of Chapter Exercises

1. Write a polynomial of degree 3 in the variable x, in which the coefficient of the x^2 term is −7.

Answer:
A polynomial of degree 3 has the general form: $ax^3 + bx^2 + cx + d$
Given that coefficient of x^2 is −7, so b = −7
One such polynomial is $x^3 - 7x^2 + 2x + 1$.
(Any polynomial of degree 3 with −7 as the coefficient of x^2 is correct)

2. Find the values of the following polynomials at the indicated values of the variables.

(i) $5x^2 - 3x + 7$ if x = 1
(ii) $4t^3 - t^2 + 6$ if t = a

Answer:
(i) $5x^2 - 3x + 7$ if x = 1
Substitute x = 1:
$= 5(1)^2 - 3(1) + 7$
= 5 − 3 + 7
= 9

(ii) $4t^3 - t^2 + 6$ if $t = a$
Substitute $t = a$:
$= 4a^3 - a^2 + 6$

3. If we multiply a number by 5/2 and add 2/3 to the product, we get -7/12. Find the number.

Answer:
Let the number be x.
According to the question:
$(5/2)x + 2/3 = -7/12$
Subtract 2/3 from both sides, we get:
$(5/2)x = -7/12 - 2/3$
$\Rightarrow (5/2)x = -7/12 - 8/12$
$\Rightarrow (5/2)x = -15/12$
$\Rightarrow (5/2)x = -5/4$
Now multiply both sides by 2/5, we get:
$x = (-5/4) \times (2/5)$
$\Rightarrow x = -1/2$
Therefore, the number is -1/2.

4. A positive number is 5 times another number. If 21 is added to both the numbers, then one of the new numbers becomes twice the other new number. What are the numbers?

Answer:
Let the smaller number be x.
Then the larger number = 5x

After adding 21 to both numbers: New numbers are x + 21 and 5x + 21
According to the question: 5x + 21 = 2(x + 21)
⇒ 5x + 21 = 2x + 42
⇒ 5x – 2x = 42 – 21
⇒ 3x = 21
⇒ x = 7
So, the smaller number = 7 and the larger number = 5 × 7 = 35
Therefore, the two numbers are 7 and 35.

5. If you have ₹800 and you save ₹250 every month, find the amount you have after (i) 6 months (ii) 2 years. Express this as a linear pattern.

Answer:
Initial amount = ₹800
Saving every month = ₹250
Linear pattern: Amount after n months = 800 + 250n
(i) Amount after 6 months:
= 800 + 250(6)
= 800 + 1500
= ₹2300

(ii) Amount after 2 years: 2 years = 24 months
Amount after 24 months:
= 800 + 250(24)
= 800 + 6000
= ₹6800
Therefore:
Amount after 6 months = ₹2300

Amount after 2 years = ₹6800
Linear pattern: A = 800 + 250n, where n is the number of months.

6. The digits of a two-digit number differ by 3. If the digits are interchanged, and the resulting number is added to the original number, we get 143. Find both the numbers.

Answer:
Let the tens digit be x and the units digit be y.
Then the original number = 10x + y
The interchanged number = 10y + x
According to the question: (10x + y) + (10y + x) = 143
⇒ 11x + 11y = 143
⇒ 11(x + y) = 143
⇒ x + y = 13 …(1)
The digits differ by 3.
So, x – y = 3 …(2)
Now adding (1) and (2), we get:
2x = 16
⇒ x = 8
Substitute x = 8 in (1), we have:
8 + y = 13
⇒ y = 5
Therefore, the original number = 85 and the interchanged number = 58
Hence, the two numbers are 85 and 58.

7. Draw the graph of the following equations, and identify their slopes and y-intercepts. Also, find the coordinates of the points where these lines cut the y-axis.

(i) y = -3x + 4
(ii) 2y = 4x + 7
(iii) 5y = 6x – 10
(iv) 3y = 6x – 11
Are any of the lines parallel?

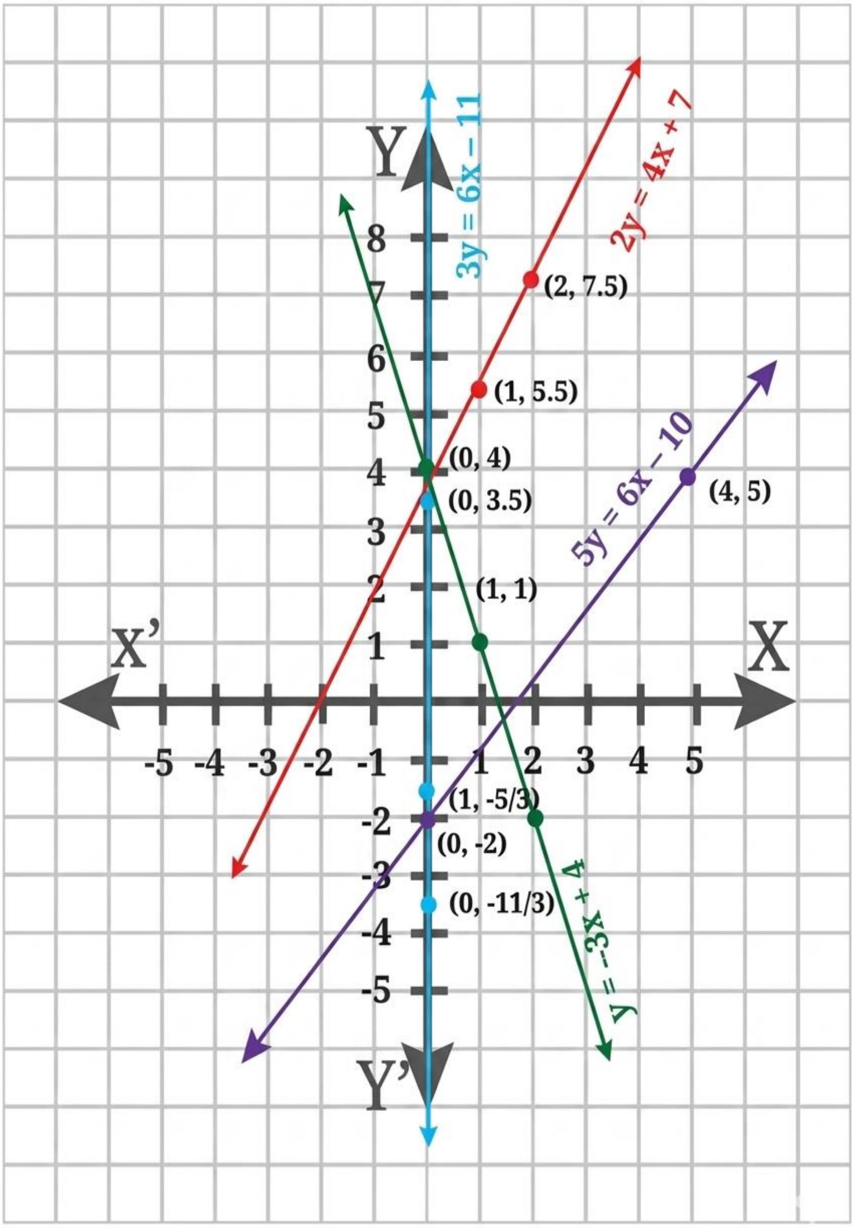
Answer:
(i) y = -3x + 4
Comparing with y = ax + b:
Slope a = -3
y-intercept b = 4
So, the point, where the line cuts the y-axis, is (0, 4).

(ii) 2y = 4x + 7
Dividing both sides by 2: y = 2x + 7/2
Slope a = 2
y-intercept b = 7/2
So, the point, where the line cuts the y-axis, is (0, 7/2).

(iii) 5y = 6x – 10
Dividing both sides by 5: y = (6/5)x – 2
Slope a = 6/5
y-intercept b = -2
So, the point, where the line cuts the y-axis is (0, -2).

(iv) 3y = 6x – 11
Dividing both sides by 3: y = 2x – 11/3
Slope a = 2
y-intercept b = -11/3
So, the point, where the line cuts the y-axis is (0, -11/3).

Parallel lines:
Two lines are parallel if they have the same slope.
Equation (ii): slope = 2
Equation (iv): slope = 2
Therefore, lines (ii) and (iv) are parallel.



8. If the temperature of a liquid can be measured in Kelvin units as x K and in Fahrenheit units as y °F, the relation between the two systems of measurement of temperature is given by the linear equation y = (9/5)(x – 273) + 32

(i) Find the temperature of the liquid in Fahrenheit if the temperature of the liquid is 313 K.
(ii) If the temperature is 158 °F, then find the temperature in Kelvin.

Answer:
(i) When x = 313 K, We have to find y:
Using equation y = (9/5)(x – 273) + 32, we have
y = (9/5)(313 – 273) + 32
⇒ y = (9/5)(40) + 32
⇒ y = 72 + 32
⇒ y = 104
Therefore, the temperature is 104 °F.

(ii) When y = 158 °F, we have to find x:
Using equation y = (9/5)(x – 273) + 32, we have
158 = (9/5)(x – 273) + 32
Subtracting 32 from both sides, we get:
158 – 32 = (9/5)(x – 273)
⇒ 126 = (9/5)(x – 273)
Multiply both sides by 5/9, we get:
126 × (5/9) = x – 273
⇒ 70 = x – 273
⇒ x = 343
Therefore, the temperature is 343 K.

9. The work done by a body on the application of a constant force is the product of the constant force and the distance travelled by the body in the direction of the force.

Express this in the form of a linear equation in two variables (work w and distance d), and draw its graph by taking the constant force as 3 units. What is the work done when the distance travelled is 2 units? Verify it by plotting it on the graph.

Answer:

We know that:

Work done = Force × Distance

According to question, work done = w

Distance travelled = d

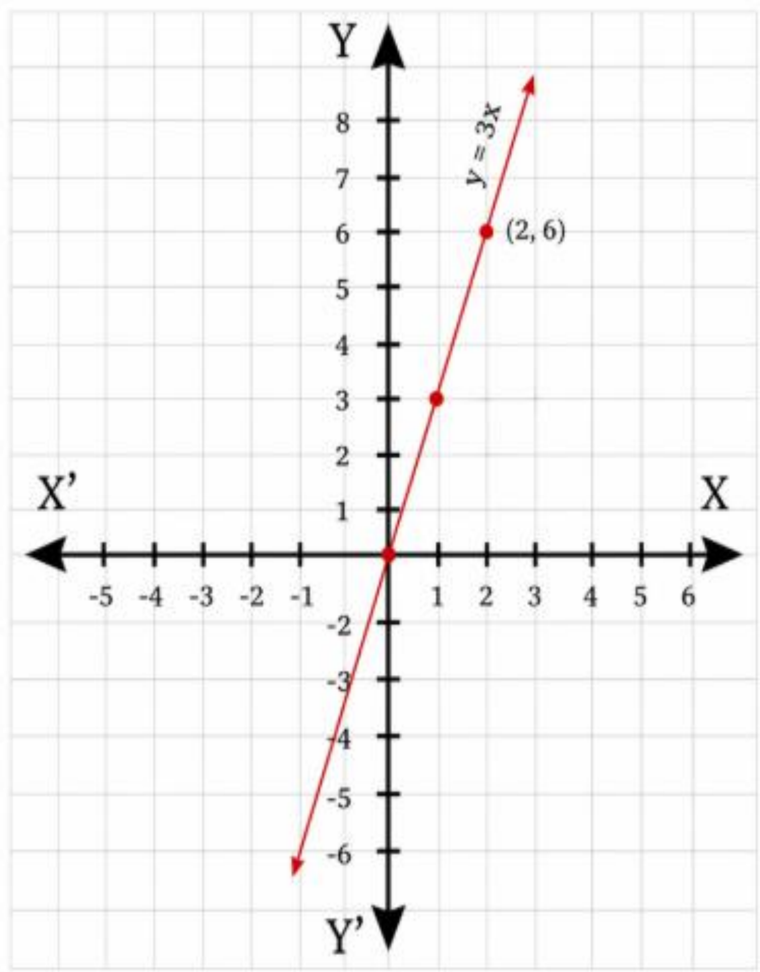
Constant force = 3 units

Therefore, $w = 3d$

This is the required linear equation in two variables.

If d = 2 units, force $w = 3 \times 2 = 6$ units.

Taking w on y-axis and d on x-axis, we can plot the graph.



The point (2, 6) lie on a straight line, so, it is verified by graph.
So, the Work done when distance travelled is 2 units: w = 3 × 2
Hence, w = 6 units
Verification from graph:
The point corresponding to d = 2 is (2, 6), so the work done is 6 units.

10. The graph of a linear polynomial p(x) passes through the points (1, 5) and (3, 11).

(i) Find the polynomial p(x).
(ii) Find the coordinates where the graph of p(x) cuts the axes.

(iii) Draw the graph of p(x) and verify your answers.

Answer:

(i) Let p(x) = ax + b

Since the graph passes through (1, 5),

a(1) + b = 5

⇒ a + b = 5 …(1)

Since the graph passes through (3, 11),

a(3) + b = 11

⇒ 3a + b = 11 …(2)

Subtracting (1) from (2), we get:

3a + b – (a + b) = 11 – 5

⇒ 2a = 6

⇒ a = 3

Substituting a = 3 in (1), we have:

3 + b = 5

⇒ b = 2

Therefore, p(x) = 3x + 2.

(ii) Coordinates where the graph cuts the axes:

To find the y-axis intercept: Put x = 0

y = p(0) = 3(0) + 2 = 2

So, the graph cuts the y-axis at (0, 2).

To find the x-axis intercept: Put y = 0

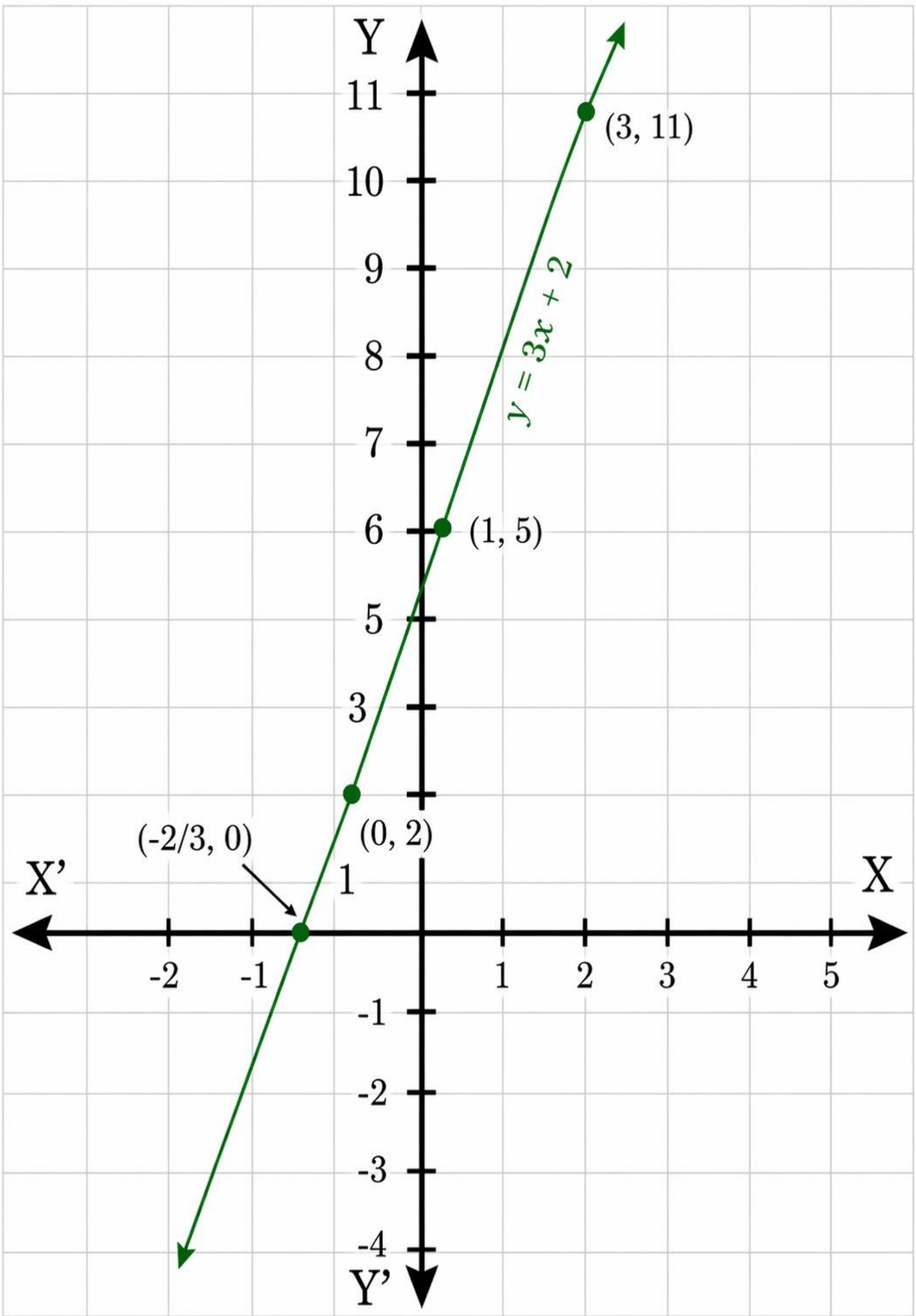
3x + 2 = 0

⇒ 3x = -2

⇒ x = -2/3

So, the graph cuts the x-axis at (-2/3, 0).

(iii) From the graph, it verifies that the line passes through the given points and cuts:
y-axis at (0, 2)
x-axis at (-2/3, 0).



11. Let p(x) = ax + b and q(x) = cx + d be two linear polynomials such that:

(i) p(0) = 5
(ii) The polynomial p(x) − q(x) cuts the x-axis at (3, 0).
(iii) The sum p(x) + q(x) is equal to 6x + 4 for all real x.
Find the polynomials p(x) and q(x).

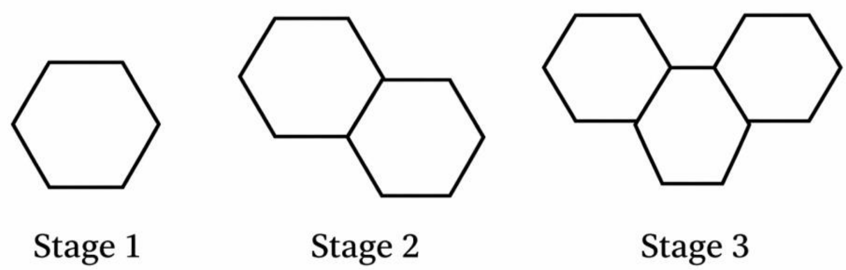
Answer:
Let p(x) = ax + b and q(x) = cx + d
Using the condition (i), we have p(0) = 5
⇒ a(0) + b = 5
⇒ b = 5
So, p(x) = ax + 5
Now, using condition (iii), we have
p(x) + q(x) = 6x + 4
⇒ (ax + 5) + (cx + d) = 6x + 4
⇒ (a + c)x + (5 + d) = 6x + 4
Comparing coefficients, we get a + c = 6 …(1)

5 + d = 4
⇒ d = –1
So, q(x) = cx – 1
Using condition (ii), p(x) − q(x) cuts x-axis at (3, 0)
⇒ p(3) − q(3) = 0
Here:
p(3) = 3a + 5
q(3) = 3c – 1

So, (3a + 5) − (3c − 1) = 0
⇒ 3a + 5 − 3c + 1 = 0
⇒ 3a − 3c + 6 = 0
⇒ a − c = –2 …(2)

Solving equations
From (1): a + c = 6
From (2): a − c = –2
Adding both: 2a = 4 ⇒ a = 2
Then: 2 + c = 6 ⇒ c = 4
Hence:
p(x) = 2x + 5
q(x) = 4x − 1.

12. Look at the first three stages of a growing pattern of hexagons made using matchsticks. A new hexagon gets added at every stage which shares a side with the last hexagon of the previous stage.



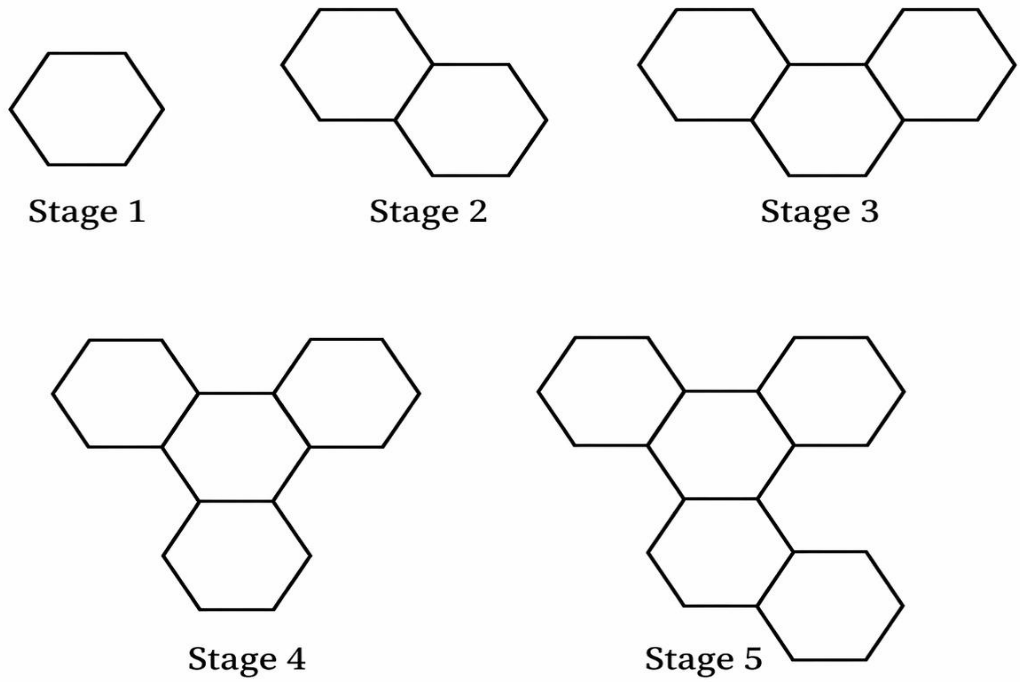
(i) Draw the next two stages of the pattern. How many matchsticks will be required at these stages?
(ii) Complete the following table.

Stage Number	1	2	3	4	5	...	n
Number of matchsticks							

(iii) Find a rule to determine the number of matchsticks required for the n^{th} stage.
(iv) How many matchsticks will be required for the 15th stage of the pattern?
(v) Can 200 matchsticks form a stage in this pattern? Justify your answer.

Answer:
A single hexagon needs 6 matchsticks.
Since each new hexagon shares one side with the previous hexagon, only 5 new matchsticks are added at every new stage.
So the pattern is:
Stage 1 = 6
Stage 2 = 6 + 5 = 11
Stage 3 = 11 + 5 = 16
(i) Next two stages:
Stage 4: Number of matchsticks = 16 + 5 = 21
Stage 5: Number of matchsticks = 21 + 5 = 26
Therefore:

- Stage 4 requires 21 matchsticks
- Stage 5 requires 26 matchsticks



(ii) Complete table:

Stage Number	1	2	3	4	5	...	n
Number of matchsticks	6	11	16	21	26		$5n + 1$

(iii) Rule for the n^{th} stage:
The number of matchsticks forms an arithmetic pattern: 6, 11, 16, 21, 26, …
First term = 6
Difference = 5
So, Number of matchsticks in the n^{th} stage
$= 6 + (n – 1) × 5$

$= 6 + 5n - 5$
$= 5n + 1$
Hence, the rule is $M_n = 5n + 1$

(iv) Matchsticks required for the 15th stage:
$M_{15} = 5(15) + 1$
$= 75 + 1$
$= 76$
Therefore, 76 matchsticks will be required for the 15th stage.

(v) Can 200 matchsticks form a stage in this pattern?
For some stage n,
$5n + 1 = 200$
$\Rightarrow 5n = 199$
$\Rightarrow n = 199/5$
$\Rightarrow n = 39.8$
Since n is not a whole number, 200 matchsticks cannot form any stage in this pattern.
Therefore, 200 matchsticks cannot form a stage in this pattern.

13. Let p(x) = ax + b and q(x) = cx + d be two linear polynomials such that:

(i) The graph of p(x) passes through the points (2, 3) and (6, 11).
(ii) The graph of q(x) passes through the point (4, -1).
(iii) The graph of q(x) is parallel to the graph of p(x).
Find the polynomials p(x) and q(x). Also, find the coordinates of the point where these lines meet the x-axis.
Answer:
Given:

p(x) = ax + b
q(x) = cx + d
First, to find p(x).
Since p(x) passes through (2, 3) and (6, 11), its slope is m = (11 – 3) / (6 – 2)
= 8/4 = 2
So, p(x) = 2x + b
Using the point (2, 3), we have:
3 = 2(2) + b
⇒ 3 = 4 + b
⇒ b = -1
Therefore, p(x) = 2x – 1.

Now to find q(x).
Since q(x) is parallel to p(x), it has the same slope.
So, slope of q(x) = 2
Hence, q(x) = 2x + d
Since q(x) passes through (4, -1), so -1 = 2(4) + d
⇒ -1 = 8 + d
⇒ d = -9
Therefore, q(x) = 2x – 9

Now we have to find where these lines meet the x-axis.
A line meets the x-axis where y = 0.
For p(x) = 2x – 1: 0 = 2x – 1
⇒ 2x = 1
⇒ x = 1/2
So, p(x) meets the x-axis at (1/2, 0).

For q(x) = 2x – 9: 0 = 2x – 9
⇒ 2x = 9

⇒ x = 9/2
So, q(x) meets the x-axis at (9/2, 0).

Hence, p(x) = 2x – 1 and q(x) = 2x – 9.
The x-axis intercepts are:
For p(x): (1/2, 0)
For q(x): (9/2, 0)

14. What do all linear functions of the form f(x) = ax + a, a > 0, have in common?

Answer:
Given: f(x) = ax + a, where a > 0
We can write it as: f(x) = a(x + 1)
Common properties of all such linear functions are:

1. Slope:
   The slope is a, and since a > 0, all the lines have positive slope.
   So, all these lines rise from left to right.
2. y-intercept:
   Putting x = 0,
   f(0) = a
   So, the y-intercept is (0, a).
   Since a > 0, all the lines cut the y-axis above the origin.
3. x-intercept:
   To find where the line cuts the x-axis, put f(x) = 0
   ax + a = 0
   a(x + 1) = 0
   Since a > 0, a is not zero.
   So, x + 1 = 0

or x = -1
Thus, every line cuts the x-axis at the same point (-1, 0).

Therefore, all linear functions of the form f(x) = ax + a, a > 0, have the following in common:

- all have positive slope
- all cut the y-axis above the origin
- all pass through the fixed point (-1, 0).