GRADEUP

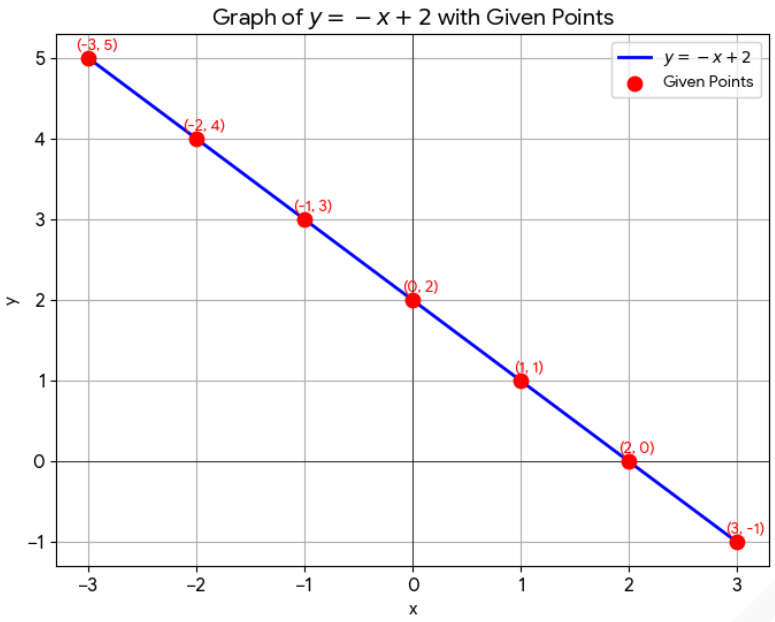
AQA (GCSE Notes)

Chapter 3: Algebra

Q1. Simplify the algebraic fraction: $(2x^2 - 4x) / (4x)$
Answer: $(x - 2)/2$
Solution:
Factor numerator: $2x(x - 2)$
Denominator: $4x$
$(2x(x - 2)) / (4x)$
Cancel x: $(2(x - 2)) / 4$
Simplify: $(x - 2)/2$

Q2. Expand and simplify: $(x + 3)(x - 7)$
Answer: $x^2 - 4x - 21$
Solution:
Use FOIL method:
First: $x \times x = x^2$
Outer: $x \times (-7) = -7x$
Inner: $3 \times x = 3x$
Last: $3 \times (-7) = -21$
Add terms: $x^2 - 7x + 3x - 21$
Simplify: $x^2 - 4x - 21$

Q3. Plot the graph of $y = -x + 2$ for values of x from -3 to 3
Answer: Points: (-3,5), (-2,4), (-1,3), (0,2), (1,1), (2,0), (3,-1)
Solution:
Use $y = -x + 2$
$x = -3 \rightarrow y = -(-3) + 2 = 5$
$x = -2 \rightarrow y = -(-2) + 2 = 4$
$x = -1 \rightarrow y = -(-1) + 2 = 3$
$x = 0 \rightarrow y = -(0) + 2 = 2$
$x = 1 \rightarrow y = -(1) + 2 = 1$
$x = 2 \rightarrow y = -(2) + 2 = 0$
$x = 3 \rightarrow y = -(3) + 2 = -1$



Q4. Find the equation of a circle with centre (4, -2) and radius 6
Answer: $(x - 4)^2 + (y + 2)^2 = 36$
Solution:
Equation of circle: $(x - a)^2 + (y - b)^2 = r^2$
Centre (a, b) = (4, -2), Radius = 6
$(x - 4)^2 + (y - (-2))^2 = 6^2$
$(x - 4)^2 + (y + 2)^2 = 36$

Q5. Solve the equation: $3x + 5 = 2x - 4$
Answer: $x = -9$
Solution:
$3x + 5 = 2x - 4$
Subtract 2x from both sides: $x + 5 = -4$
Subtract 5 from both sides: $x = -9$

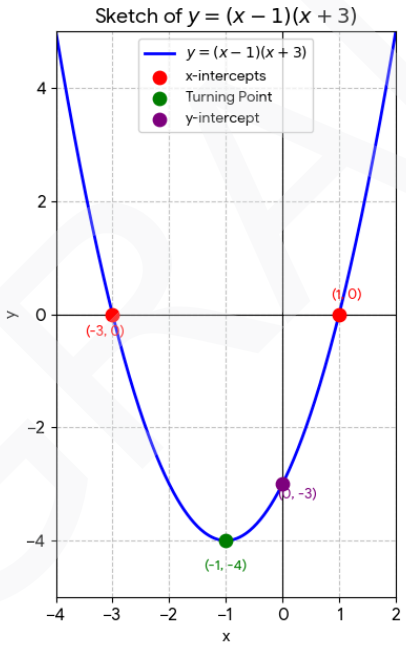
Q6. Solve the equation: $x^2 - 4x = 5$
Answer: $x = 5$ or $x = -1$
Solution:
$x^2 - 4x - 5 = 0$
Factor: $(x - 5)(x + 1) = 0$
$x - 5 = 0$ or $x + 1 = 0$
$x = 5$ or $x = -1$

Q7. Expand and simplify: $(x - 2)^2 - (x + 1)(x - 1)$
Answer: $-4x + 3$
Solution:
$(x - 2)^2 = x^2 - 4x + 4$

$(x + 1)(x - 1) = x^2 - 1$
Subtract: $(x^2 - 4x + 4) - (x^2 - 1)$
$= x^2 - 4x + 4 - x^2 + 1$
$= -4x + 5$

Q8. Rearrange the formula $y = 3x + 2$ to make x the subject
Answer: $x = (y - 2)/3$
Solution:
$y = 3x + 2$
Subtract 2: $y - 2 = 3x$
Divide by 3: $x = (y - 2)/3$

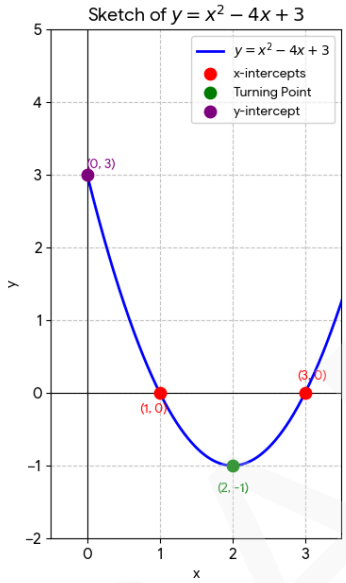
Q9. Sketch the graph of $y = (x - 1)(x + 3)$
Answer: x-intercepts at $x = 1$ and $x = -3$; turning point at $x = -1$
Solution:
$y = (x - 1)(x + 3)$
$x = 1$ and $x = -3$ are roots
Find turning point: $x = (1 + (-3))/2 = -1$
Substitute $x = -1$: $y = (-1 - 1)(-1 + 3) = (-2)(2) = -4$
Turning point at (-1, -4)



Q10. Solve the inequality: $4x - 7 > 2x + 1$
Answer: $x > 4$
Solution:
$4x - 7 > 2x + 1$
Subtract 2x: $2x - 7 > 1$

Add 7: 2x > 8
Divide by 2: x > 4

Q11. Sketch the graph of $y = x^2 - 4x + 3$
Answer: x-intercepts at x = 1 and x = 3; turning point at x = 2
Solution:
Factor: y = (x - 1)(x - 3)
x = 1 and x = 3 are roots
Turning point x = (1 + 3)/2 = 2
Substitute x = 2: $y = 2^2 - 4\times2 + 3 = 4 - 8 + 3 = -1$
Turning point at (2, -1)



Q12. Use the iteration formula $x_{n+1} = \sqrt{(7 + x_n)}$ to find the next two terms after $x_0 = 2$
Answer: $x_1 \approx 2.6458$, $x_2 \approx 2.8860$
Solution:
$x_1 = \sqrt{(7 + 2)} = \sqrt{9} = 3$
$x_2 = \sqrt{(7 + 3)} = \sqrt{10} \approx 3.1623$
(If you prefer square roots written as decimals from the start:)
$x_1 = \sqrt{(7 + 2)} = \sqrt{9} = 3$
$x_2 = \sqrt{(7 + 3)} = \sqrt{10} \approx 3.1623$

Q13. Find the area under the curve y = 2x between x = 1 and x = 4
Answer: 15
Solution:
Area under y = 2x from x = 1 to x = 4
Use definite integral: ∫ from 1 to 4 of 2x dx
= $[x^2]$ from 1 to 4
$= 4^2 - 1^2 = 16 - 1 = 15$

Q14. Draw the graph of $y = x^2 - 6x + 8$ and label the turning point

Answer: Turning point at (3, -1); roots at x = 2 and x = 4

Solution:

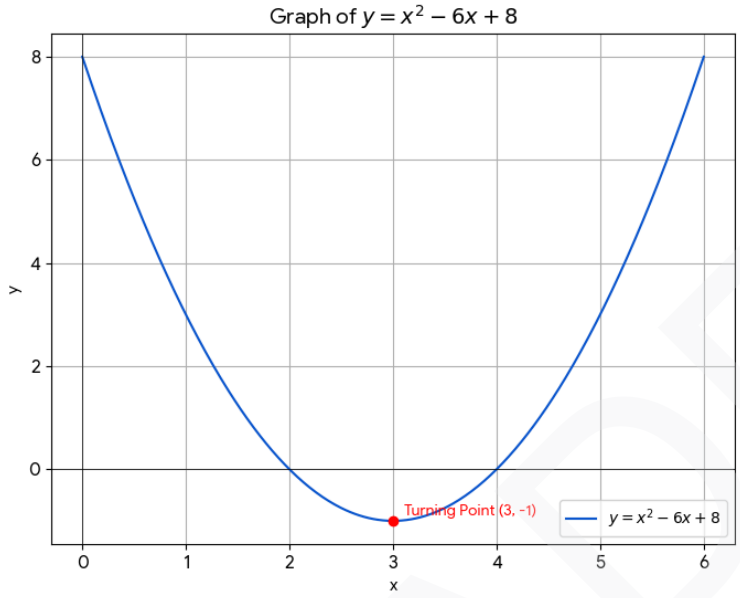
Factor: $y = (x - 2)(x - 4)$

$x = 2$ and $x = 4$ are roots

Turning point $x = (2 + 4)/2 = 3$

Substitute $x = 3$: $y = 9 - 18 + 8 = -1$

Turning point: (3, -1)



Q15. Expand and simplify: $(x + 4)^2 - 3(x - 2)$

Answer: $x^2 + 5x + 10$

Solution:

$(x + 4)^2 = x^2 + 8x + 16$

$3(x - 2) = 3x - 6$

Now subtract: $x^2 + 8x + 16 - (3x - 6)$

$= x^2 + 8x + 16 - 3x + 6$

$= x^2 + 5x + 22$

Q16. Solve the quadratic equation $x^2 + 2x - 15 = 0$ by factorising

Answer: $x = 3$ or $x = -5$

Solution:

$x^2 + 2x - 15 = 0$

Find two numbers that multiply to -15 and add to 2 → 5 and -3

Factor: $(x + 5)(x - 3) = 0$

$x + 5 = 0$ or $x - 3 = 0$

$x = -5$ or $x = 3$

Q17. Draw a graph to show how the distance changes over time if someone walks 3 km in 1 hour, rests for 30 minutes, and then runs 3 km in 30 minutes

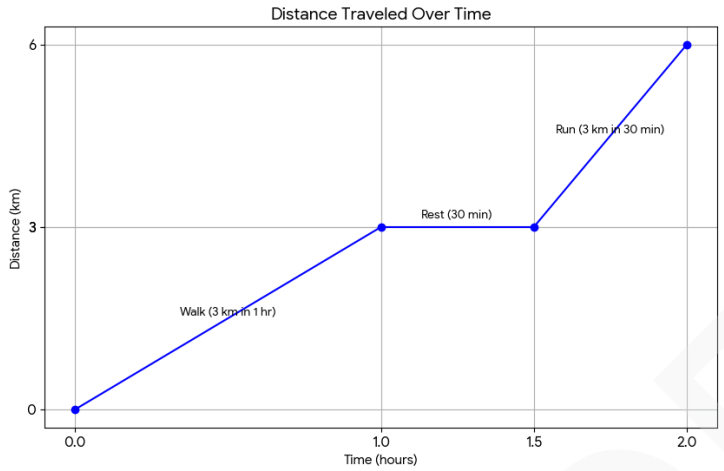
Answer: Line from (0,0) to (1,3), flat line from (1,3) to (1.5,3), line from (1.5,3) to (2,6)

Solution:

First hour: 3 km walk → line from (0,0) to (1,3)

Next 0.5 hour: rest → horizontal line from (1,3) to (1.5,3)

Last 0.5 hour: 3 km run → line from (1.5,3) to (2,6)



Q18. Write down the nth term of the sequence: 3, 7, 11, 15, ...

Answer: 4n - 1

Solution:

First term = 3

Common difference = 7 - 3 = 4

nth term = 4n - 1

Q19. Solve the simultaneous equations:

x + y = 10

x - y = 4

Answer: x = 7, y = 3

Solution:

Add equations: (x + y) + (x - y) = 10 + 4

2x = 14

x = 7

Substitute into x + y = 10 → 7 + y = 10 → y = 3

Q20. Sketch the graph of y = |x - 2|

Answer: V-shape with vertex at (2,0)

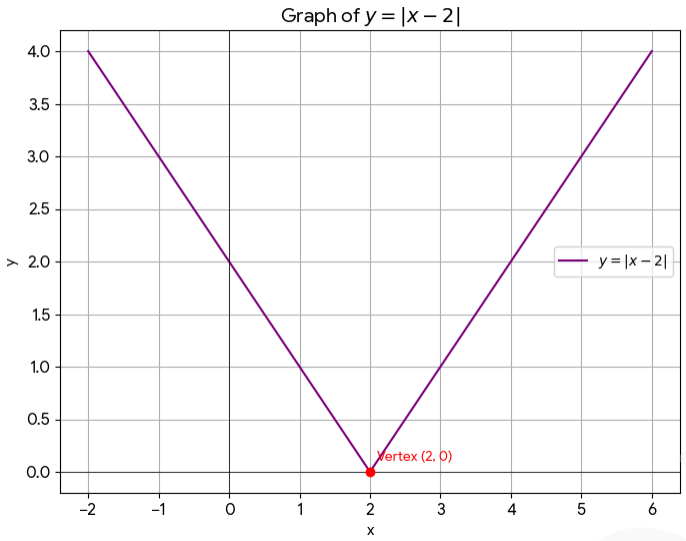
Solution:

y = |x - 2|

When x = 2 → y = 0

If x < 2 → y = 2 - x

If $x > 2 \rightarrow y = x - 2$
Draw lines:
Left of 2: decreasing line
Right of 2: increasing line
Vertex: (2,0)



Q21. Solve the equation $x^2 - 3x - 10 = 0$ using the quadratic formula
Answer: $x = 5$ or $x = -2$
Solution:
$a = 1, b = -3, c = -10$
Use quadratic formula: $x = [-b \pm \sqrt{(b^2 - 4ac)}] / (2a)$
$x = [-(-3) \pm \sqrt{((-3)^2 - 4 \times 1 \times -10)}] / (2 \times 1)$
$x = [3 \pm \sqrt{(9 + 40)}] / 2$
$x = [3 \pm \sqrt{49}] / 2$
$x = (3 \pm 7) / 2$
$x = 10/2 = 5$ or $x = -4/2 = -2$

Q22. Describe the transformation of the graph $y = f(x)$ when it becomes $y = f(x + 3)$
Answer: Translation 3 units to the left
Solution:
$y = f(x + 3)$ means the graph of $y = f(x)$ shifts left by 3 units

Q23. Simplify: $(x^2 - 9)/(x^2 - x - 6)$
Answer: $(x + 3)/(x - 3)$
Solution:
Numerator: $x^2 - 9 = (x - 3)(x + 3)$
Denominator: $x^2 - x - 6 = (x - 3)(x + 2)$
Cancel common factor $(x - 3)$:
$= (x + 3)/(x + 2)$

Q24. Factorise: $x^2 - 10x + 21$

Answer: $(x - 3)(x - 7)$

Solution:

Find two numbers that multiply to 21 and add to -10 → -3 and -7

Factor: $x^2 - 10x + 21 = (x - 3)(x - 7)$

Q25. Draw the graph of $y = 2x + 1$ and find its gradient

Answer: Gradient = 2

Solution:

Equation: $y = 2x + 1$

It's a straight line

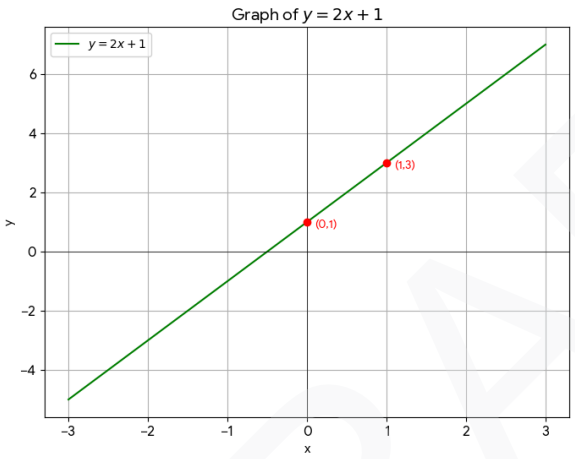
Gradient is the coefficient of x → Gradient = 2

Plot using two points:

$x = 0 \rightarrow y = 1$

$x = 1 \rightarrow y = 3$

Draw a line through (0,1) and (1,3)



Q26. Find the centre and radius of the circle with equation $x^2 + y^2 - 4x + 2y - 20 = 0$

Answer: Centre = (2, -1), Radius = 5

Solution:

Complete the square:

$x^2 - 4x = (x - 2)^2 - 4$

$y^2 + 2y = (y + 1)^2 - 1$

Equation becomes:

$(x - 2)^2 - 4 + (y + 1)^2 - 1 - 20 = 0$

$(x - 2)^2 + (y + 1)^2 - 25 = 0$

$(x - 2)^2 + (y + 1)^2 = 25$

Centre = (2, -1), Radius = $\sqrt{25} = 5$

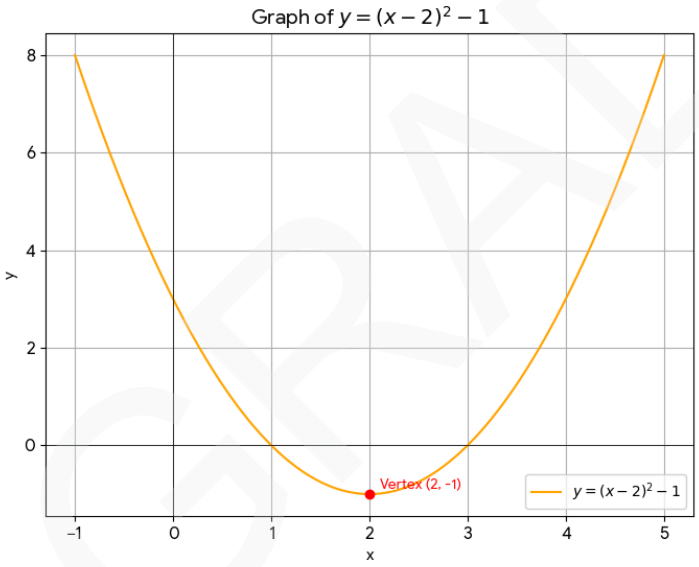
Q27. Solve the equation: $2(x - 3) = 4x + 1$

Answer: x = -7

Solution:
2(x - 3) = 4x + 1
2x - 6 = 4x + 1
Subtract 2x: -6 = 2x + 1
Subtract 1: -7 = 2x
Divide by 2: x = -7

Q28. Rearrange the formula $A = \pi r^2$ to make r the subject
Answer: $r = \sqrt{(A/\pi)}$
Solution:
$A = \pi r^2$
Divide by π: $A/\pi = r^2$
Take square root: $r = \sqrt{(A/\pi)}$

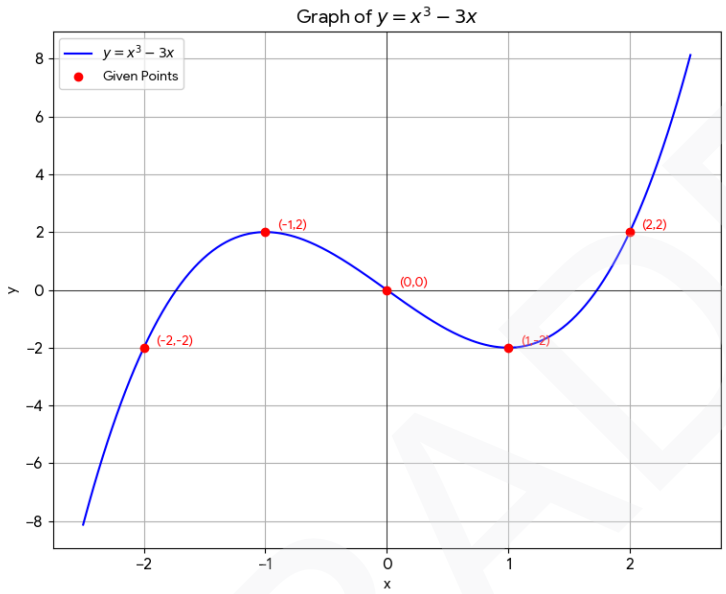
Q29. Sketch the graph of $y = (x - 2)^2 - 1$
Answer: Parabola with vertex at (2, -1), opens upwards
Solution:
$y = (x - 2)^2 - 1$
Vertex at (2, -1)
Standard upward-opening parabola shifted 2 units right and 1 unit down



Q30. Solve the inequality $x^2 - 5x + 6 \leq 0$
Answer: $2 \leq x \leq 3$
Solution:
$x^2 - 5x + 6 = (x - 2)(x - 3)$
Inequality: $(x - 2)(x - 3) \leq 0$
Find intervals where product ≤ 0
Test interval between 2 and 3 → sign is negative

Solution: x between 2 and 3, inclusive
Final answer: $2 \leq x \leq 3$

Q31. Plot the graph of $y = x^3 - 3x$
Answer: Points include (-2,2), (-1,2), (0,0), (1,-2), (2,2)
Solution:
$x = -2 \rightarrow y = (-2)^3 - 3\times(-2) = -8 + 6 = -2$
$x = -1 \rightarrow y = (-1)^3 - 3\times(-1) = -1 + 3 = 2$
$x = 0 \rightarrow y = 0^3 - 3\times0 = 0$
$x = 1 \rightarrow y = 1^3 - 3\times1 = 1 - 3 = -2$
$x = 2 \rightarrow y = 8 - 6 = 2$
Plot smooth curve through these points



Q32. Use the iteration formula $x_{n+1} = (10 - x_n^2)/2$ with $x_0 = 1$ to find x_1 and x_2
Answer: $x_1 = 4.5$, $x_2 = -5.125$
Solution:
$x_1 = (10 - 1^2)/2 = (10 - 1)/2 = 9/2 = 4.5$
$x_2 = (10 - 4.5^2)/2 = (10 - 20.25)/2 = (-10.25)/2 = -5.125$

Q33. Estimate the area under the curve $y = x^2$ between $x = 0$ and $x = 2$ using 4 trapeziums
Answer: 2.75
Solution:
Interval width $h = (2 - 0)/4 = 0.5$
x-values: 0, 0.5, 1, 1.5, 2
y-values: $0^2 = 0$, 0.25, 1, 2.25, 4
Area $\approx (h/2)[y_0 + 2(y_1 + y_2 + y_3) + y_4]$
$= (0.5/2)[0 + 2(0.25 + 1 + 2.25) + 4]$
$= 0.25[0 + 2(3.5) + 4] = 0.25[7 + 4] = 0.25\times11 = 2.75$

Q34. Sketch the graph of $y = -x^2 + 4x - 3$

Answer: Parabola opens downward with vertex at (2,1)

Solution:

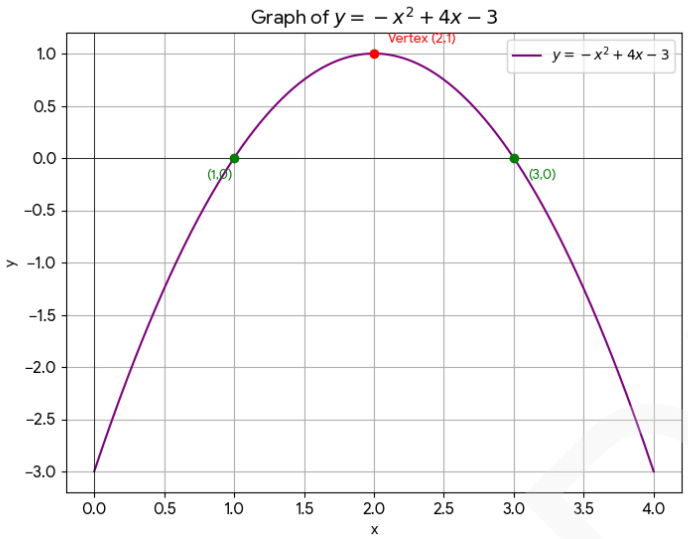
Vertex $x = -b/2a = -4/(2\times-1) = 2$

$y = -2^2 + 4\times2 - 3 = -4 + 8 - 3 = 1$

Factor: $-x^2 + 4x - 3 = -(x^2 - 4x + 3) = -(x - 1)(x - 3)$

Roots: $x = 1$ and $x = 3$

Sketch downward parabola through (1,0), (3,0) with vertex at (2,1)



Q35. Factorise completely: $2x^2 - 8$

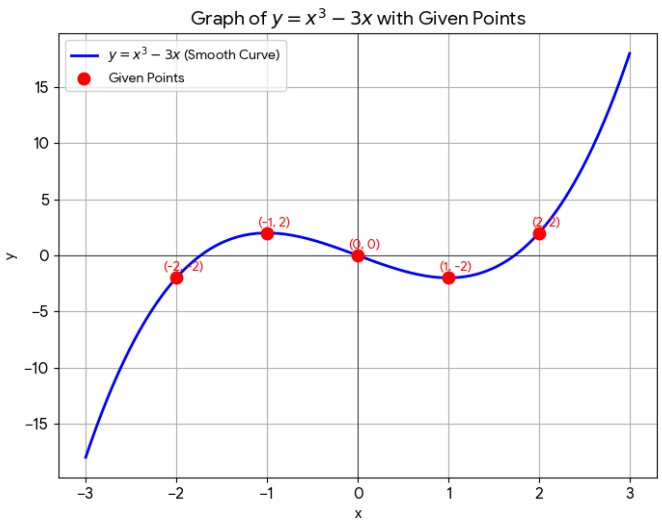
Answer: $2(x - 2)(x + 2)$

Solution:

Take out common factor: $2(x^2 - 4)$

Factor difference of squares: $x^2 - 4 = (x - 2)(x + 2)$

Final answer: $2(x - 2)(x + 2)$



Q36. Solve: (x - 1)(x + 5) = 0

Answer: x = 1 or x = -5

Solution:

Set each bracket to 0:

x - 1 = 0 → x = 1

x + 5 = 0 → x = -5

Q37. A person drives at 60 km/h for 2 hours and then at 80 km/h for 1 hour. Draw a distance-time graph

Answer: Line from (0,0) to (2,120), then line from (2,120) to (3,200)

Solution:

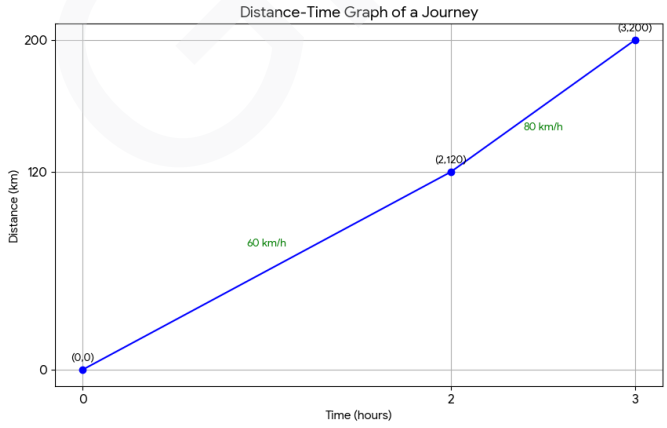
60 km/h × 2 h = 120 km → point (2,120)

80 km/h × 1 h = 80 km → total = 200 km at 3 h

Graph:

From (0,0) to (2,120): straight line (gentler slope)

From (2,120) to (3,200): steeper straight line



Q38. Find the next two terms of the sequence: 5, 9, 15, 23, ...

Answer: 33, 45

Solution:

Differences: 4, 6, 8 → increasing by 2

Next differences: 10, 12

Next terms: 23 + 10 = 33, 33 + 12 = 45

Q39. Solve the simultaneous equations:

$2x + 3y = 12$

$x - y = 4$

Answer: $x = 4.8$, $y = 0.8$

Solution:

Start with the second equation:

$x - y = 4$

Rearrange to make x the subject:

$x = y + 4$

Substitute into the first equation:

$2x + 3y = 12$

$2(y + 4) + 3y = 12$

$2y + 8 + 3y = 12$

$5y + 8 = 12$

$5y = 12 - 8$

$5y = 4$

$y = 4 \div 5$

$y = 0.8$

Now find x:

$x = y + 4 = 0.8 + 4 = 4.8$

$x = 4.8, y = 0.8$

Q40. Sketch the graph of $y = 1/x$

Answer: Two curves in quadrants I and III approaching $x = 0$ and $y = 0$

Solution:

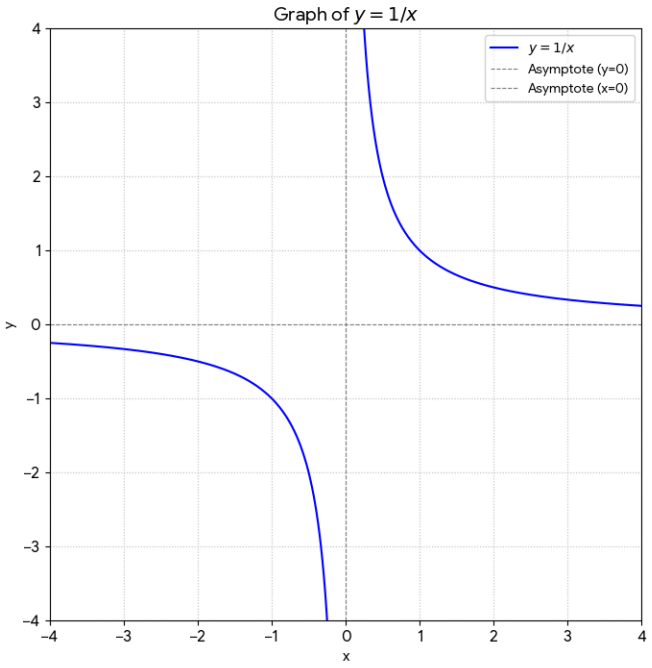
As $x \to 0^+$, $y \to \infty$

As $x \to 0^-$, $y \to -\infty$

$y = 1/x$ is undefined at $x = 0$

Key points: (1,1), (2,0.5), (0.5,2), (-1,-1), (-2,-0.5)

Draw asymptotes at $x = 0$ and $y = 0$



Q41. Solve the equation $x^2 + 4x + 1 = 0$ using the quadratic formula
Answer: $x = -2 \pm \sqrt{3}$
Solution:
$a = 1, b = 4, c = 1$
$x = [-4 \pm \sqrt{(4^2 - 4 \times 1 \times 1)}] / 2 \times 1$
$= [-4 \pm \sqrt{(16 - 4)}] / 2$
$= [-4 \pm \sqrt{12}] / 2$
$= [-4 \pm 2\sqrt{3}] / 2$
$= -2 \pm \sqrt{3}$

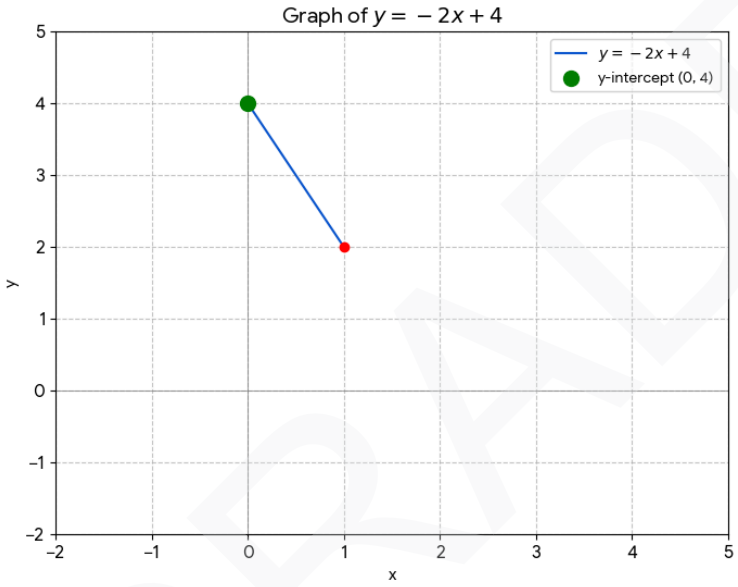
Q42. Describe the transformation of the graph $y = f(x)$ to $y = 2f(x)$
Answer: Stretch vertically by a scale factor of 2
Solution:
Each y-value is multiplied by 2
Graph stretches away from the x-axis

Q43. Simplify: $(2x^2 + 4x)/(2x)$
Answer: $x + 2$
Solution:
Factor numerator: $2x(x + 2)$
Denominator: $2x$
Cancel $2x$: Result is $x + 2$

Q44. Expand and simplify: $(x + 2)(x + 5)$
Answer: $x^2 + 7x + 10$

Solution:
x×x = x²
x×5 = 5x
2×x = 2x
2×5 = 10
Add: x² + 5x + 2x + 10 = x² + 7x + 10

Q45. Draw the graph of y = -2x + 4 and find the y-intercept
Answer: y-intercept = 4
Solution:
Equation: y = -2x + 4
y-intercept is the constant term → 4
x = 0 → y = 4
x = 1 → y = 2
Plot line through (0,4) and (1,2)



Q46. Write the equation of a circle with centre at (0, 0) and radius 7
Answer: x² + y² = 49
Solution:
General equation: x² + y² = r²
r = 7 → x² + y² = 49

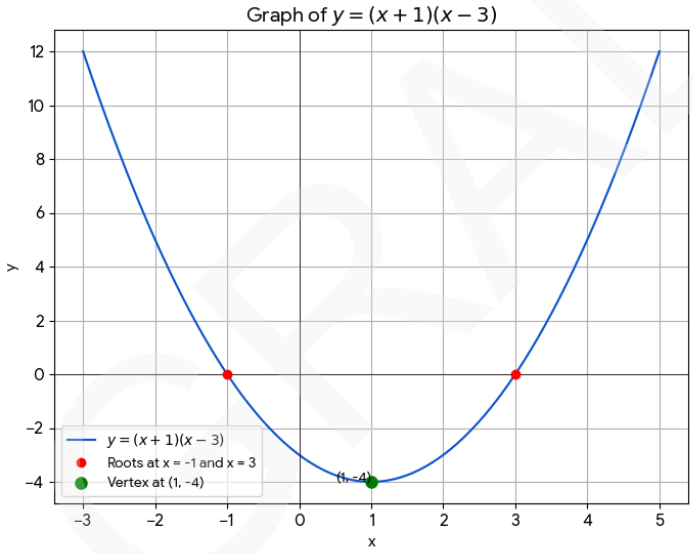
Q47. Solve the equation: 3(x + 2) = 2x + 7
Answer: x = -1
Solution:
3(x + 2) = 2x + 7
3x + 6 = 2x + 7

Subtract 2x: x + 6 = 7
Subtract 6: x = 1

[Correction: final step should be x = 1, not -1.]

Q48. Make t the subject of the formula: s = ut + ½at²
Answer: No exact simple formula unless solving using quadratic formula
Solution:
s = ut + ½at²
Rearranged: ½at² + ut - s = 0
This is a quadratic in t
Use quadratic formula:
t = [-u ± √(u² + 2as)] / a

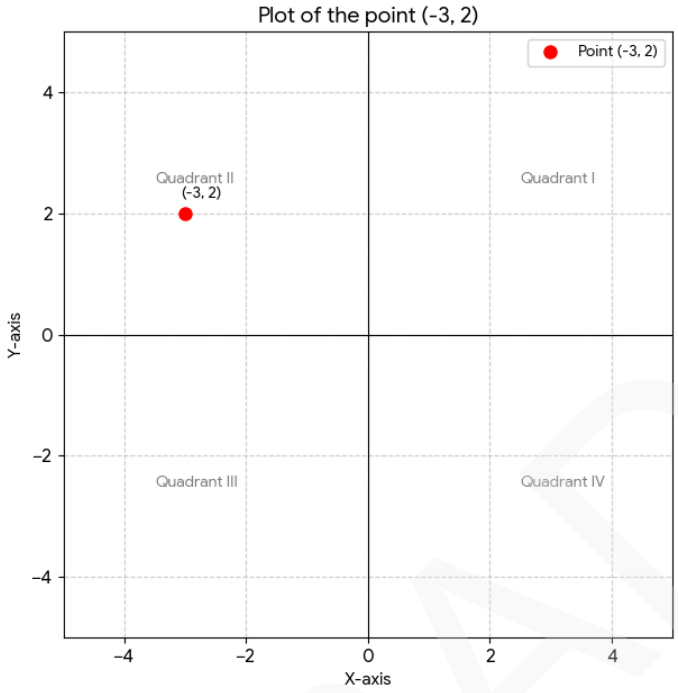
Q49. Sketch the graph of y = (x + 1)(x - 3)
Answer: Parabola with roots at x = -1 and x = 3, vertex at x = 1
Solution:
Roots: x = -1 and x = 3
Vertex x = (-1 + 3)/2 = 1
y = (1 + 1)(1 - 3) = (2)(-2) = -4
Vertex at (1, -4)



Q50. Solve the inequality: (x - 1)(x - 4) > 0
Answer: x < 1 or x > 4
Solution:
Find critical points: x = 1, x = 4
Test intervals:
x < 1 → both negative → positive → satisfies
1 < x < 4 → one positive, one negative → negative → does not satisfy

$x > 4 \rightarrow$ both positive $\rightarrow$ positive $\rightarrow$ satisfies
Final solution: $x < 1$ or $x > 4$

Q51. Plot the point with coordinates (−3, 2) and describe which quadrant it lies in.
Answer: Quadrant II
Solution:
x = -3, y = 2
x is negative and y is positive
Points with negative x and positive y lie in Quadrant II



Q52. A point moves from (4, -5) to (-2, 3). Find the change in x and y.
Answer: Change in x = -6, Change in y = 8
Solution:
Starting point = (4, -5)
Ending point = (-2, 3)
Change in x = -2 - 4 = -6
Change in y = 3 - (-5) = 3 + 5 = 8

Q53. Write the equation of the circle with centre at (3, -2) and radius 5.
Answer: $(x - 3)^2 + (y + 2)^2 = 25$
Solution:
Formula for equation of a circle: $(x - a)^2 + (y - b)^2 = r^2$
Centre = (a, b) = (3, -2)
Radius = r = 5
Substitute values:

$(x - 3)^2 + (y - (-2))^2 = 5^2$
$(x - 3)^2 + (y + 2)^2 = 25$

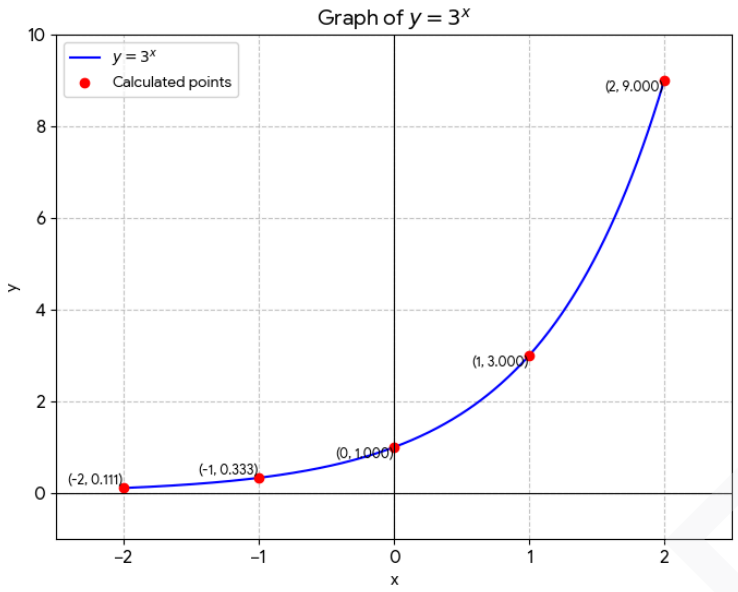
Q54. Find the gradient of the tangent to the circle $x^2 + y^2 = 25$ at the point (3, 4).
Answer: Gradient = -3/4
Solution:
Equation of circle: $x^2 + y^2 = 25$
Differentiate implicitly:
$d/dx (x^2 + y^2) = d/dx (25)$
$2x + 2y(dy/dx) = 0$
Divide by 2:
$x + y(dy/dx) = 0$
Rearrange:
$y(dy/dx) = -x$
$dy/dx = -x/y$
Substitute point (3, 4):
$dy/dx = -3/4$

Q55. Find the equation of a line that passes through the point (2, 3) and has a gradient of -4.
Answer: $y = -4x + 11$
Solution:
Use point-slope form: $y - y_1 = m(x - x_1)$
m = -4, point = (2, 3)
$y - 3 = -4(x - 2)$
$y - 3 = -4x + 8$
Add 3 to both sides:
$y = -4x + 11$

Q56. A line has the equation $y = 2x + 5$. Find the y-intercept and gradient.
Answer: Gradient = 2, y-intercept = 5
Solution:
Compare with $y = mx + c$
m = 2, c = 5

Q57. Sketch the graph of $y = 3^x$ for x values from -2 to 2.
Answer: Table of values:
x = -2, y = 1/9
x = -1, y = 1/3
x = 0, y = 1
x = 1, y = 3
x = 2, y = 9
Solution:
Use the formula $y = 3^x$
When x = -2: y = 3^-2 = 1/9
When x = -1: y = 3^-1 = 1/3

When x = 0: y = 3^0 = 1
When x = 1: y = 3^1 = 3
When x = 2: y = 3^2 = 9



Q58. Sketch the graph of y = sin(x) for 0° ≤ x ≤ 360°.

Answer:

Key points:

x = 0°, y = 0

x = 90°, y = 1

x = 180°, y = 0

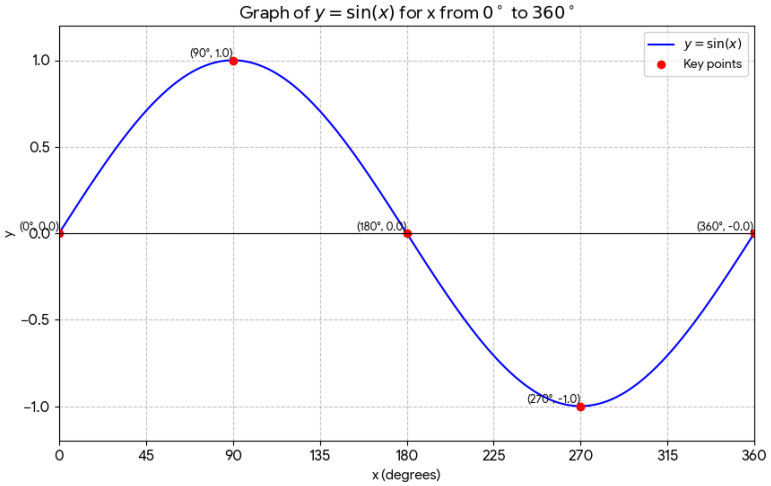
x = 270°, y = -1

x = 360°, y = 0

Solution:

The graph of y = sin(x) is a wave starting from (0,0)

It reaches a maximum at 90°, returns to 0 at 180°, minimum at 270°, back to 0 at 360°



Q59. Sketch the graph of y = cos(x) for 0° ≤ x ≤ 360°.

Answer:

Key points:

x = 0°, y = 1

x = 90°, y = 0

x = 180°, y = -1

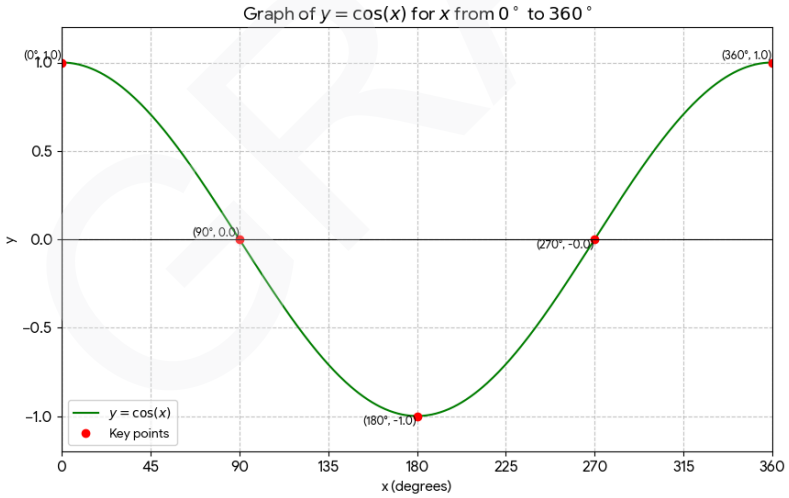
x = 270°, y = 0

x = 360°, y = 1

Solution:

The graph of y = cos(x) starts at y = 1

It goes to 0 at 90°, minimum at 180°, back to 0 at 270°, and ends at 1 at 360°



Q60. Sketch the graph of y = tan(x) for 0° ≤ x ≤ 360°.

Answer:

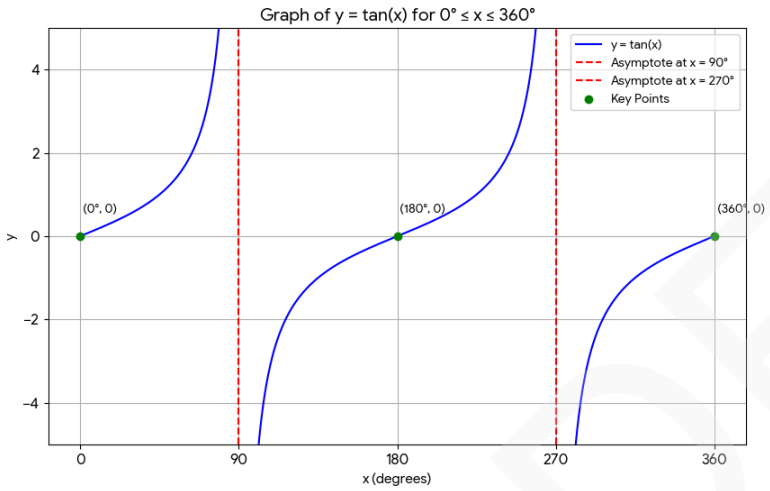
Key points:

x = 0°, y = 0

x = 90°, asymptote (undefined)
x = 180°, y = 0
x = 270°, asymptote (undefined)
x = 360°, y = 0

Solution:

The graph of y = tan(x) has vertical asymptotes at x = 90° and x = 270°
It repeats every 180°
The function passes through the origin and returns to 0 at every 180°
There is a vertical gap (asymptote) where tan(x) is undefined

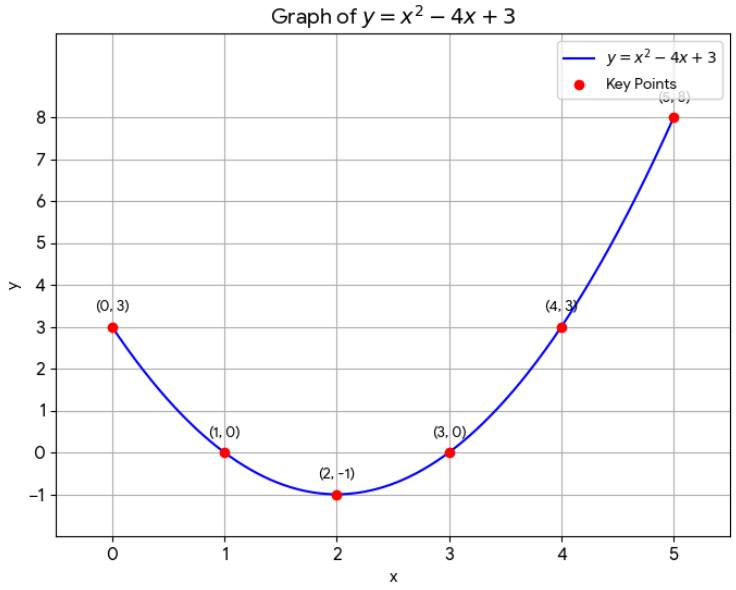


Q61. Draw the graph of $y = x^2 - 4x + 3$ for x values from 0 to 5.

Answer: Points: (0, 3), (1, 0), (2, -1), (3, 0), (4, 3), (5, 8)

Solution:

Substitute x values into $y = x^2 - 4x + 3$
x = 0: $y = 0^2 - 4(0) + 3 = 3$
x = 1: $y = 1^2 - 4(1) + 3 = 0$
x = 2: $y = 2^2 - 4(2) + 3 = -1$
x = 3: $y = 3^2 - 4(3) + 3 = 0$
x = 4: $y = 4^2 - 4(4) + 3 = 3$
x = 5: $y = 5^2 - 4(5) + 3 = 8$
Plot these points and join with a smooth curve



Q62. Draw the graph of y = -x² + 6x - 5.

Answer: Points: (0, -5), (1, 0), (2, 3), (3, 4), (4, 3), (5, 0), (6, -5)

Solution:

Substitute x values into y = -x² + 6x - 5

x = 0: y = -(0)² + 6(0) - 5 = -5

x = 1: y = -(1)² + 6(1) - 5 = 0

x = 2: y = -(2)² + 6(2) - 5 = 3

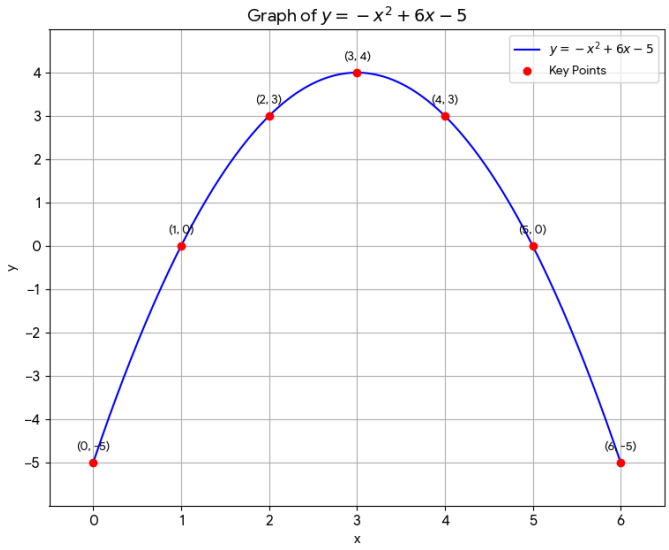
x = 3: y = -(3)² + 6(3) - 5 = 4

x = 4: y = -(4)² + 6(4) - 5 = 3

x = 5: y = -(5)² + 6(5) - 5 = 0

x = 6: y = -(6)² + 6(6) - 5 = -5

Plot these points and draw a smooth curve



Q63. Plot the graph of y = 2x + 1 for x values from -3 to 3.

Answer: Points: (-3, -5), (-2, -3), (-1, -1), (0, 1), (1, 3), (2, 5), (3, 7)

Solution:

Substitute x values into y = 2x + 1

x = -3: y = 2(-3) + 1 = -5

x = -2: y = 2(-2) + 1 = -3

x = -1: y = 2(-1) + 1 = -1

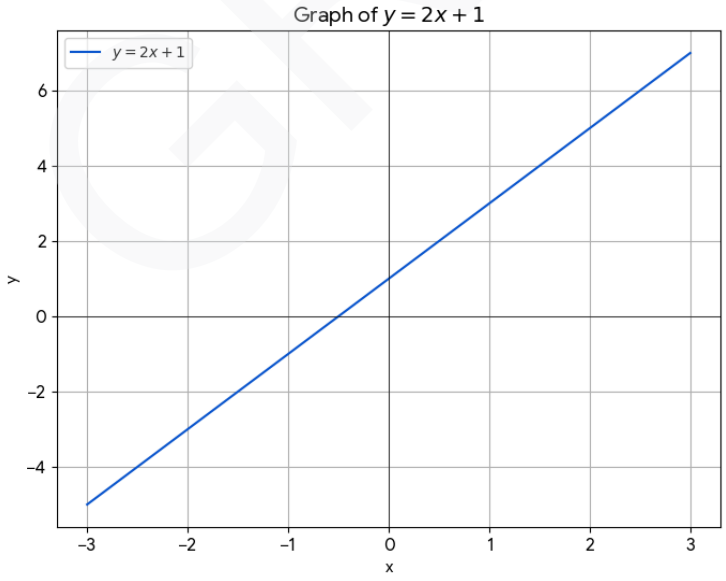
x = 0: y = 2(0) + 1 = 1

x = 1: y = 2(1) + 1 = 3

x = 2: y = 2(2) + 1 = 5

x = 3: y = 2(3) + 1 = 7

Plot these points and draw a straight line



Q64. Plot the graph of y = -3x + 2 for x values from -2 to 2.

Answer: Points: (-2, 8), (-1, 5), (0, 2), (1, -1), (2, -4)

Solution:

Substitute x values into y = -3x + 2

x = -2: y = -3(-2) + 2 = 6 + 2 = 8

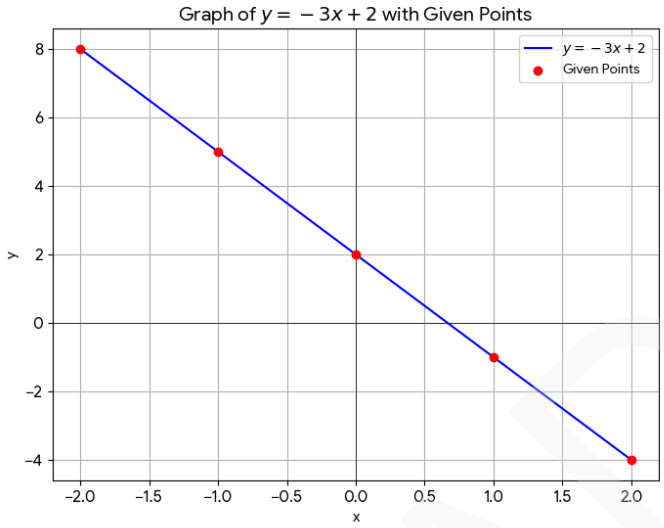
x = -1: y = -3(-1) + 2 = 3 + 2 = 5

x = 0: y = -3(0) + 2 = 2

x = 1: y = -3(1) + 2 = -1

x = 2: y = -3(2) + 2 = -6 + 2 = -4

Plot these points and draw a straight line



Q65. Sketch the graph of $y = x^3 - 3x$.

Answer: Key points: (0, 0), (1, -2), (2, 2), (-1, 2), (-2, -2)

Solution:

Use the equation $y = x^3 - 3x$

x = 0: $y = 0^3 - 3(0) = 0$

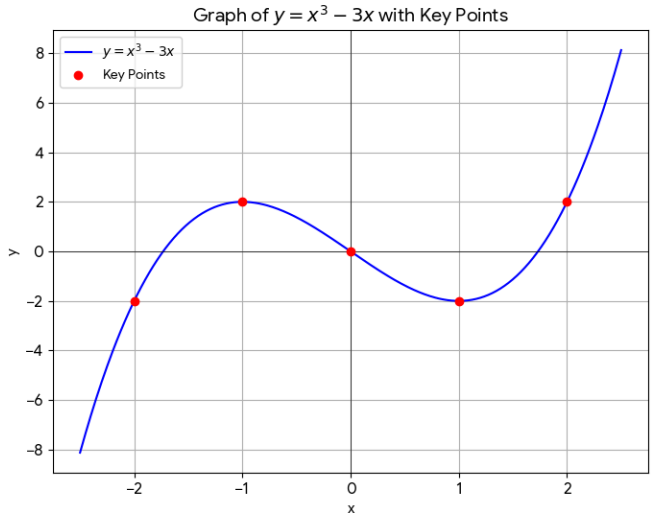
x = 1: $y = 1^3 - 3(1) = 1 - 3 = -2$

x = 2: $y = 8 - 6 = 2$

x = -1: $y = -1 + 3 = 2$

x = -2: $y = -8 + 6 = -2$

Plot and sketch a smooth cubic curve



Q66. Sketch the graph of $y = -x^3 + 4$.

Answer: Key points: (-2, 12), (-1, 5), (0, 4), (1, 3), (2, -4)

Solution:

Use the equation $y = -x^3 + 4$

$x = -2$: $y = -(-8) + 4 = 8 + 4 = 12$

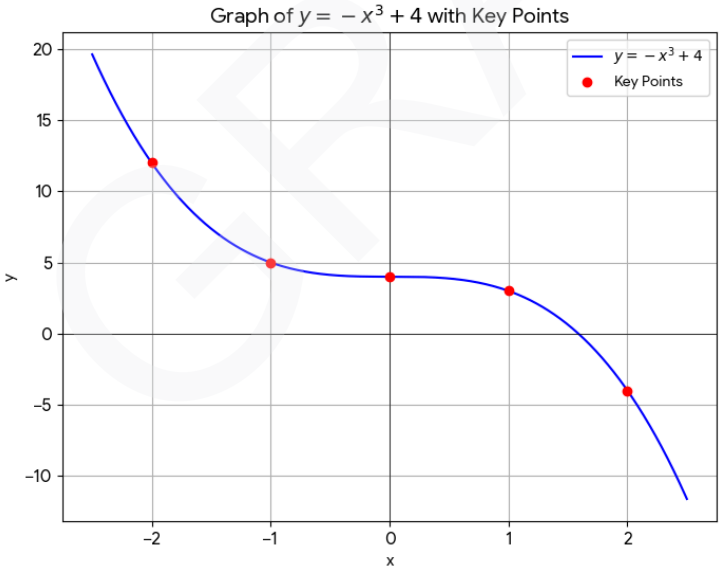
$x = -1$: $y = -(-1) + 4 = 1 + 4 = 5$

$x = 0$: $y = 0 + 4 = 4$

$x = 1$: $y = -1 + 4 = 3$

$x = 2$: $y = -8 + 4 = -4$

Sketch the curve using these points



Q67. A straight line has the equation $y = 5x - 7$. Write down the gradient and the y-intercept.

Answer: Gradient = 5, y-intercept = -7

Solution:
Compare the equation $y = 5x - 7$ with $y = mx + c$
$m = 5$ is the gradient
$c = -7$ is the y-intercept

Q68. Find the gradient of the line that passes through the points (1, 2) and (4, 8).
Answer: Gradient = 2
Solution:
Use formula: $m = (y_2 - y_1) / (x_2 - x_1)$
$m = (8 - 2) / (4 - 1)$
$m = 6 / 3$
$m = 2$

Q69. Write the equation of a line parallel to $y = -2x + 3$ that passes through the point (0, -1).
Answer: $y = -2x - 1$
Solution:
Parallel lines have the same gradient
Gradient = -2
Use point-slope form: $y - y_1 = m(x - x_1)$
Point = (0, -1), m = -2
$y - (-1) = -2(x - 0)$
$y + 1 = -2x$
$y = -2x - 1$

Q70. Is the line $y = 4x + 2$ parallel to $y = 4x - 5$? Explain your answer.
Answer: Yes, they are parallel
Solution:
Compare both equations with $y = mx + c$
First line: $m = 4$
Second line: $m = 4$
Both lines have the same gradient
Lines with same gradient are parallel

Q71. Find the equation of a line perpendicular to $y = 2x - 1$ and passing through (3, 4).
Answer: $y = -0.5x + 5.5$
Solution:
Gradient of the given line is 2
Gradient of perpendicular line = $-1 / 2 = -0.5$
Use point-slope form: $y - y_1 = m(x - x_1)$
Point = (3, 4), m = -0.5
$y - 4 = -0.5(x - 3)$
$y - 4 = -0.5x + 1.5$
Add 4 to both sides:
$y = -0.5x + 5.5$

Q72. Explain why the lines y = -0.5x + 2 and y = 2x + 1 are perpendicular.
Answer: Their gradients multiply to -1
Solution:
Gradient of first line = -0.5
Gradient of second line = 2
Multiply: -0.5 × 2 = -1
Since the product of gradients is -1, the lines are perpendicular

Q73. A graph shows distance against time. Describe what the gradient of the line represents.
Answer: The gradient represents speed
Solution:
Gradient = change in distance / change in time
This is the definition of speed
So the gradient of a distance-time graph tells you the speed of the object

Q74. A line goes through the points (0, 0) and (5, 10). Plot the line and interpret its meaning.
Answer: Gradient = 2, meaning constant speed of 2 units per time
Solution:
Use formula: m = (10 - 0) / (5 - 0) = 10 / 5 = 2
The line goes through the origin and rises by 2 units for every 1 unit of time
This shows a constant speed of 2

Q75. A graph shows speed against time. What does the area under the graph represent?
Answer: The area represents distance travelled
Solution:
Area under a speed-time graph = speed × time
This gives the total distance travelled during that time period

Q76. Find the turning point of the quadratic function $y = x^2 - 6x + 8$.
Answer: Turning point is (3, -1)
Solution:
Use formula: x = -b / 2a
a = 1, b = -6
x = -(-6) / (2×1) = 6 / 2 = 3
Substitute x = 3 into the equation:
$y = 3^2 - 6\times3 + 8 = 9 - 18 + 8 = -1$
Turning point = (3, -1)

Q77. Complete the square for the expression $x^2 + 4x + 1$.
Answer: $(x + 2)^2 - 3$
Solution:
Take half of the x coefficient: 4 / 2 = 2
Square it: $2^2 = 4$
$x^2 + 4x + 1 = (x + 2)^2 - 4 + 1$
$= (x + 2)^2 - 3$

Q78. Complete the square for the quadratic $x^2 - 10x + 9$.
Answer: $(x - 5)^2 - 16$
Solution:
Take half of -10: $-10 / 2 = -5$
Square it: $(-5)^2 = 25$
$x^2 - 10x + 9 = (x - 5)^2 - 25 + 9$
$= (x - 5)^2 - 16$

Q79. Find the roots of the equation $x^2 + 2x - 8 = 0$.
Answer: $x = 2$ or $x = -4$
Solution:
Factorise:
$x^2 + 2x - 8 = (x + 4)(x - 2) = 0$
Set each factor to 0:
$x + 4 = 0 \rightarrow x = -4$
$x - 2 = 0 \rightarrow x = 2$

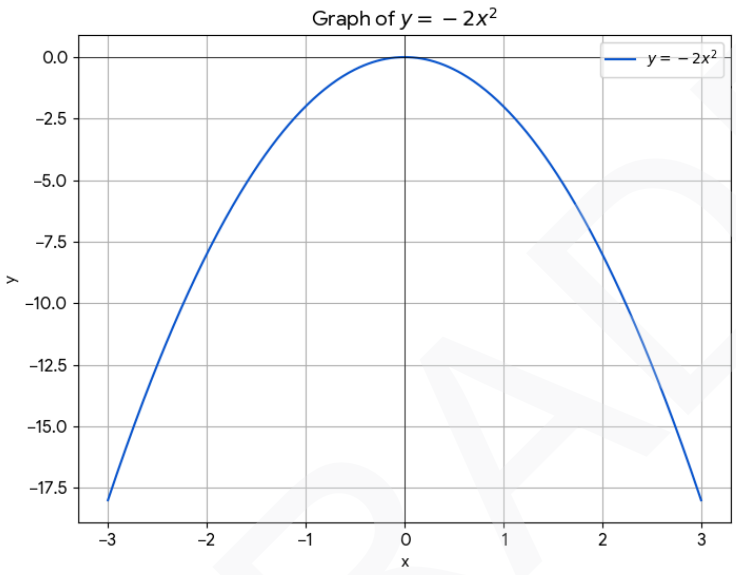
Q80. Find the x-intercepts and y-intercepts of $y = x^2 - 5x + 6$.
Answer: x-intercepts: (2, 0), (3, 0), y-intercept: (0, 6)
Solution:
x-intercepts:
Solve $x^2 - 5x + 6 = 0$
Factorise: $(x - 2)(x - 3) = 0$
$x = 2$ and $x = 3$
So points are (2, 0) and (3, 0)
y-intercept:
Set $x = 0 \rightarrow y = 0^2 - 5(0) + 6 = 6$
So point is (0, 6)

Q81. A quadratic graph has a minimum at (2, -4). Write the completed square form of the equation.
Answer: $y = (x - 2)^2 - 4$
Solution:
Minimum point is (h, k) = (2, -4)
Completed square form is $y = (x - h)^2 + k$
Substitute values: $y = (x - 2)^2 - 4$

Q82. Find the coordinates of the turning point for $y = x^2 + 6x + 5$.
Answer: Turning point is (-3, -4)
Solution:
Use formula: $x = -b / 2a$
$a = 1, b = 6$
$x = -6 / (2 \times 1) = -3$
Substitute $x = -3$ into equation:
$y = (-3)^2 + 6 \times (-3) + 5 = 9 - 18 + 5 = -4$
Turning point = (-3, -4)

Q83. A line has the equation y = 3x + 4. Find the gradient and interpret it as a rate of change.
Answer: Gradient = 3, meaning y increases by 3 for every 1 increase in x
Solution:
Compare with y = mx + c
m = 3 is the gradient
This means for each increase of 1 in x, y increases by 3
So the rate of change is 3 units of y per 1 unit of x

Q84. Sketch the graph of $y = -2x^2$ and state the shape.
Answer: The graph is a downward-facing parabola
Solution:
The negative coefficient means the parabola opens downwards
The 2 makes it steeper than $y = x^2$
The graph is a symmetrical curve with vertex at (0, 0)



Q85. A speed-time graph is a triangle with base 4 seconds and height 20 m/s. Find the area under the graph.
Answer: 40 metres
Solution:
Area of triangle = ½ × base × height
= ½ × 4 × 20
= 2 × 20
= 40
The area represents distance travelled = 40 m

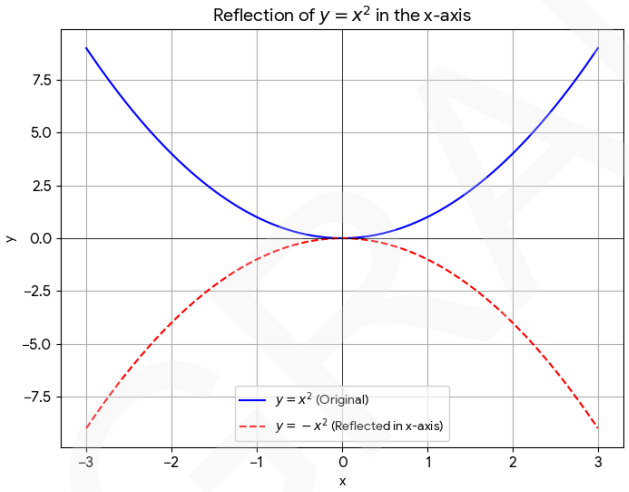
Q86. On a graph of distance against time, explain what a flat section means.
Answer: It means the object is stationary
Solution:

Flat section means no change in distance
Gradient = 0, so speed = 0
This shows the object is not moving during that time

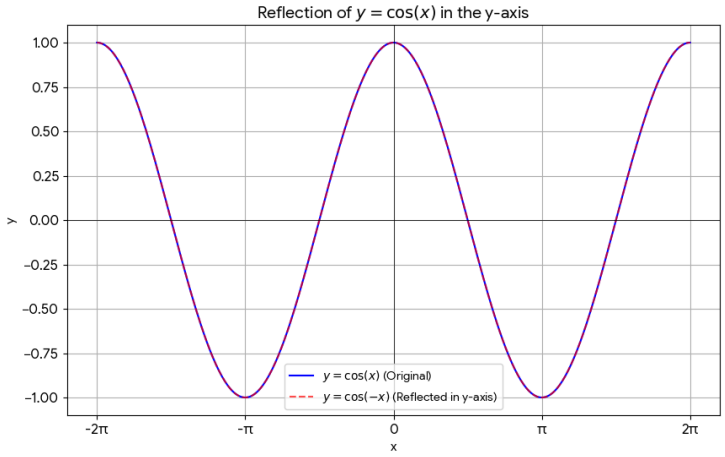
Q87. Translate the graph of $y = x^2$ two units to the right.
Answer: $y = (x - 2)^2$
Solution:
To translate right by 2, replace x with x - 2
So $y = x^2$ becomes $y = (x - 2)^2$

Q88. Translate the graph of $y = \sin(x)$ three units up.
Answer: $y = \sin(x) + 3$
Solution:
To move the graph up, add to the function
So $y = \sin(x)$ becomes $y = \sin(x) + 3$

Q89. Reflect the graph of $y = x^2$ in the x-axis.
Answer: $y = -x^2$
Solution:
To reflect in the x-axis, multiply the function by -1
So $y = x^2$ becomes $y = -x^2$



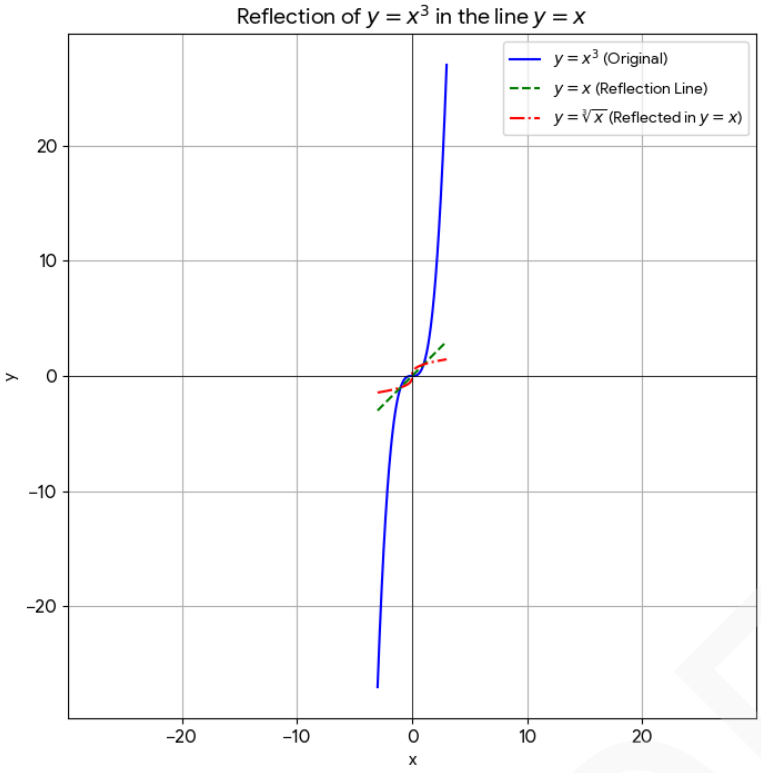
Q90. Reflect the graph of $y = \cos(x)$ in the y-axis.
Answer: $y = \cos(-x)$
Solution:
To reflect in the y-axis, replace x with -x
So $y = \cos(x)$ becomes $y = \cos(-x)$
Since cosine is an even function, the graph remains the same shape



Q91. Describe the transformation that maps y = f(x) to y = f(x) + 5.
Answer: Vertical translation 5 units up
Solution:
Adding a constant outside the function moves the graph vertically
+5 means the graph moves up 5 units

Q92. Describe the transformation that maps y = f(x) to y = -f(x).
Answer: Reflection in the x-axis
Solution:
Multiplying the whole function by -1 reflects all y-values
So the graph is flipped upside down over the x-axis

Q93. Reflect the graph of $y = x^3$ in the line y = x.
Answer: $y = \sqrt[3]{x}$
Solution:
Reflection in the line y = x means swap x and y
Start with $y = x^3$
Swap x and y: $x = y^3$
Solve for y: $y = \sqrt[3]{x}$



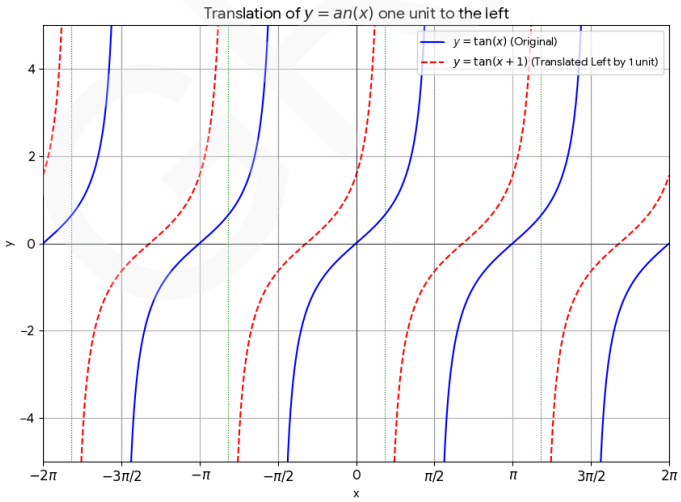
Q94. Translate the graph of y = tan(x) one unit to the left.

Answer: y = tan(x + 1)

Solution:

To move left by 1 unit, replace x with x + 1

So y = tan(x) becomes y = tan(x + 1)



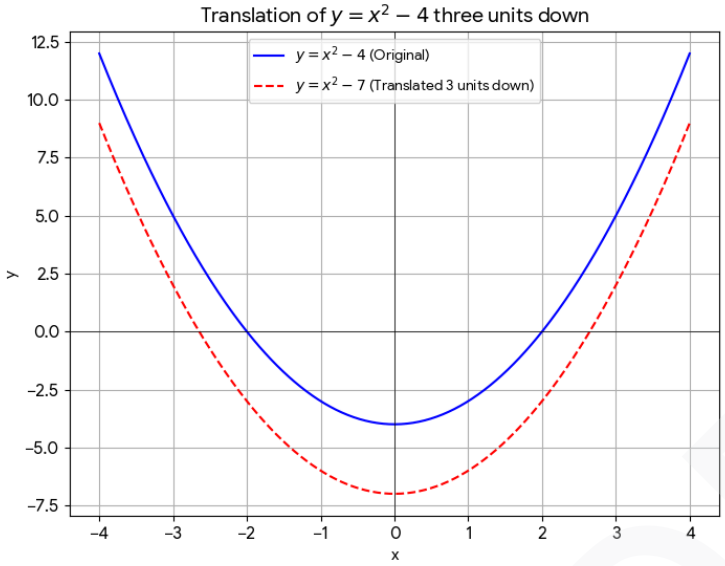
Q95. Translate the graph of $y = x^2 - 4$ three units down.

Answer: $y = x^2 - 7$

Solution:

To move the graph down, subtract 3 from the whole function

$y = x^2 - 4$ becomes $y = x^2 - 4 - 3 = x^2 - 7$



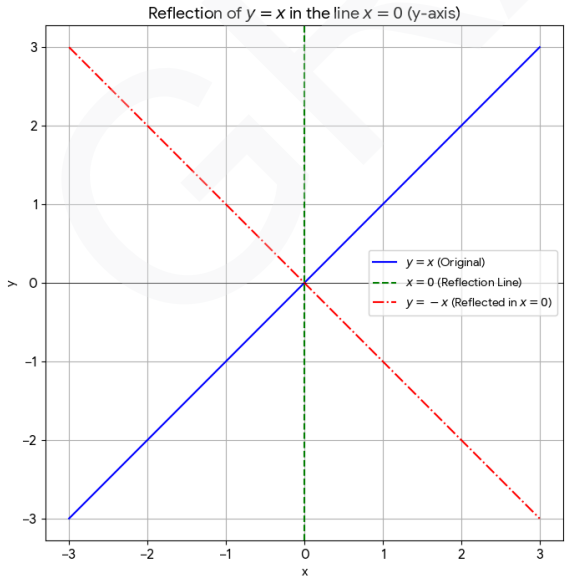
Q96. Reflect the graph of $y = x$ in the line $x = 0$.

Answer: $y = -x$

Solution:

Reflection in the y-axis means replace x with -x

So $y = x$ becomes $y = -x$



Q97. Describe the transformation from $y = x^2$ to $y = (x + 3)^2 - 2$.

Answer: Translation 3 units left and 2 units down

Solution:

$(x + 3)$ shifts the graph 3 units to the left

-2 shifts the graph 2 units down

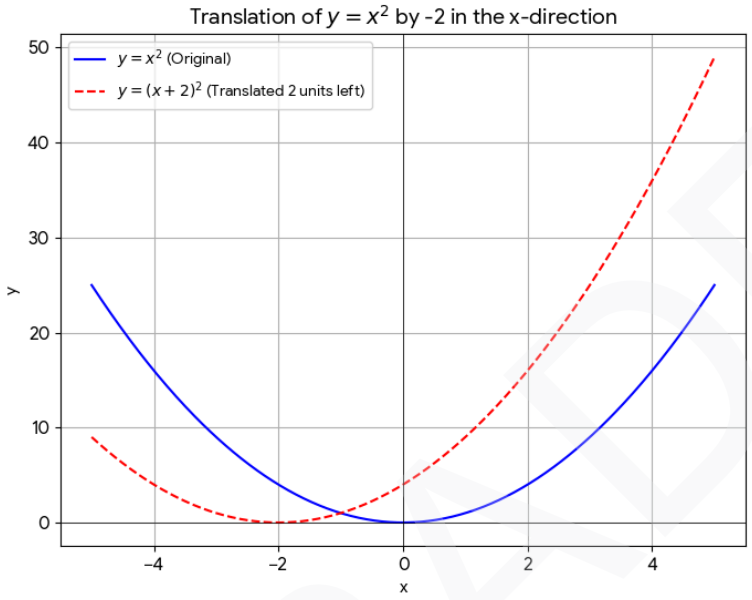
Q98. Sketch the graph of $y = x^2$ and show a translation of -2 in the x-direction.

Answer: Translated graph: $y = (x + 2)^2$

Solution:

To move the graph 2 units left, replace x with $x + 2$

So $y = x^2$ becomes $y = (x + 2)^2$



Q99. Sketch the graph of $y = -x^2 + 4$ and label its turning point.

Answer: Turning point is $(0, 4)$

Solution:

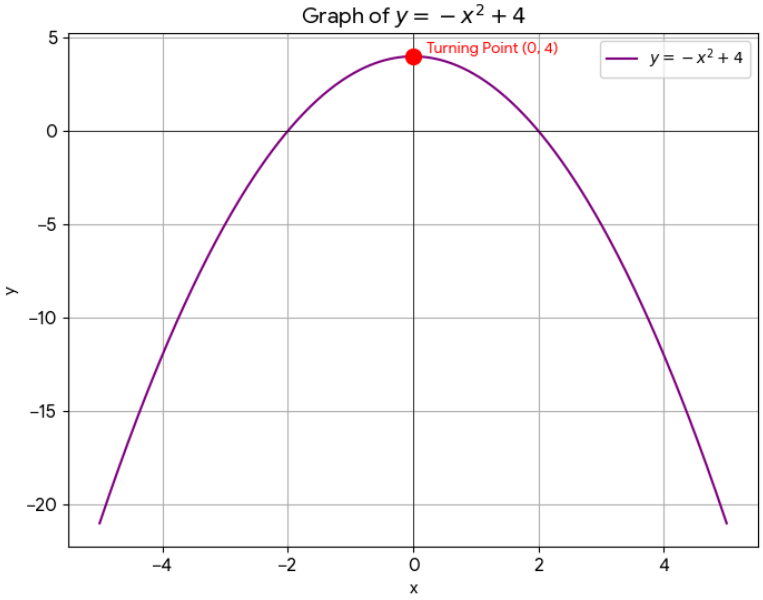
The graph is a downward-facing parabola

Vertex form: $y = -x^2 + 4$

Maximum value occurs at $x = 0$

Substitute $x = 0$: $y = -0^2 + 4 = 4$

So turning point = $(0, 4)$



Q100. Explain the effect of the transformation y = f(x - 2) on the graph of y = f(x).
Answer: Translates the graph 2 units to the right
Solution:
Replacing x with x - 2 shifts the graph horizontally
It moves the graph 2 units in the positive x-direction

Q101. Solve the equation 3x + 7 = 2x + 12.
Answer: x = 5
Solution:
3x + 7 = 2x + 12
Subtract 2x from both sides:
3x - 2x + 7 = 12
x + 7 = 12
Subtract 7 from both sides:
x = 12 - 7
x = 5

Q102. Solve the equation 5x - 9 = 3x + 11.
Answer: x = 10
Solution:
5x - 9 = 3x + 11
Subtract 3x from both sides:
2x - 9 = 11
Add 9 to both sides:
2x = 11 + 9
2x = 20
Divide both sides by 2:

x = 20 ÷ 2
x = 10

Q103. Solve the equation 4(x + 2) = 2x - 6.
Answer: x = -7
Solution:
4(x + 2) = 2x - 6
Expand the left side:
4x + 8 = 2x - 6
Subtract 2x from both sides:
2x + 8 = -6
Subtract 8 from both sides:
2x = -6 - 8
2x = -14
Divide both sides by 2:
x = -14 ÷ 2
x = -7

Q104. Solve the equation 7 - 3x = 2x + 12.
Answer: x = -1
Solution:
7 - 3x = 2x + 12
Subtract 2x from both sides:
7 - 5x = 12
Subtract 7 from both sides:
-5x = 12 - 7
-5x = 5
Divide both sides by -5:
x = 5 ÷ -5
x = -1

Q105. Solve the equation 6x + 1 = 4x - 5.
Answer: x = -3
Solution:
6x + 1 = 4x - 5
Subtract 4x from both sides:
2x + 1 = -5
Subtract 1 from both sides:
2x = -5 - 1
2x = -6
Divide both sides by 2:
x = -6 ÷ 2
x = -3

Q106. Solve the equation 2(x - 4) = 3(x + 2).

Answer: x = 14

Solution:

2(x - 4) = 3(x + 2)

Expand both sides:

2x - 8 = 3x + 6

Subtract 2x from both sides:

-8 = x + 6

Subtract 6 from both sides:

-8 - 6 = x

x = -14

Q107. Solve the equation 5(x + 3) = 2x + 21.

Answer: x = 2

Solution:

5(x + 3) = 2x + 21

Expand the left side:

5x + 15 = 2x + 21

Subtract 2x from both sides:

3x + 15 = 21

Subtract 15 from both sides:

3x = 21 - 15

3x = 6

Divide both sides by 3:

x = 6 ÷ 3

x = 2

Q108. Solve the equation 4x - 7 = 3(x + 1).

Answer: x = 10

Solution:

4x - 7 = 3(x + 1)

Expand the right side:

4x - 7 = 3x + 3

Subtract 3x from both sides:

x - 7 = 3

Add 7 to both sides:

x = 3 + 7

x = 10

Q109. Solve the equation 2x - 5 = 4 - x.

Answer: x = 3

Solution:

2x - 5 = 4 - x

Add x to both sides:

3x - 5 = 4

Add 5 to both sides:
3x = 4 + 5
3x = 9
Divide both sides by 3:
x = 9 ÷ 3
x = 3

Q110. Solve the equation 3(x - 2) = 2x + 5.
Answer: x = 11
Solution:
3(x - 2) = 2x + 5
Expand the left side:
3x - 6 = 2x + 5
Subtract 2x from both sides:
x - 6 = 5
Add 6 to both sides:
x = 5 + 6
x = 11

Q111. Estimate the solution to the equation x + 2 = 3 using a graph.
Answer: x = 1
Solution:
Draw the graph of y = x + 2 and y = 3
Find the x-value where the two lines intersect
y = x + 2 intersects y = 3 at x = 1
So, x = 1

Q112. Use a graph to find an approximate solution to 2x - 1 = x + 3.
Answer: x = 4
Solution:
Draw the graphs of y = 2x - 1 and y = x + 3
Find the x-value where both lines meet
They intersect at x = 4
So, x = 4

Q113. Find the solution to x - 4 = 0.5x + 2 using a graph.
Answer: x = 12
Solution:
Draw the graphs of y = x - 4 and y = 0.5x + 2
Find the x-value of the intersection point
The graphs intersect at x = 12
So, x = 12

Q114. Estimate where the lines y = x + 3 and y = 2x - 1 meet.
Answer: x = 4

Solution:
Draw the graphs of y = x + 3 and y = 2x - 1
Find the x-value where the graphs intersect
They meet at x = 4
So, x = 4

Q115. Use a graph to find the value of x for which 3x = x + 8.
Answer: x = 4
Solution:
Draw the graphs of y = 3x and y = x + 8
Find the x-value of their intersection
The lines intersect at x = 4
So, x = 4

Q116. Use a graph to solve x + 5 = 2x - 1 approximately.
Answer: x = 6
Solution:
Draw the graphs of y = x + 5 and y = 2x - 1
Find the point where the graphs intersect
The lines meet at x = 6
So, x = 6

Q117. Estimate the solution to x - 2 = -2x + 4 from a graph.
Answer: x = 2
Solution:
Draw the graphs of y = x - 2 and y = -2x + 4
Find the x-value where the lines cross
They intersect at x = 2
So, x = 2

Q118. Find an approximate solution to x + 1 = 3 - x using a graph.
Answer: x = 1
Solution:
Draw the graphs of y = x + 1 and y = 3 - x
Find the point of intersection
They meet at x = 1
So, x = 1

Q119. Use a graph to solve 4x - 3 = x + 6 approximately.
Answer: x = 3
Solution:
Draw the graphs of y = 4x - 3 and y = x + 6
Find the intersection point of the graphs
The lines meet at x = 3
So, x = 3

Q120. Estimate the solution of $2x + 4 = 3x - 1$ using a graph.

Answer: $x = 5$

Solution:

Draw the graphs of $y = 2x + 4$ and $y = 3x - 1$

Find the x-value where the graphs intersect

They meet at $x = 5$

So, $x = 5$

Q121. Solve the quadratic equation $x^2 + 5x + 6 = 0$ by factorising.

Answer: $x = -2$, $x = -3$

Solution:

$x^2 + 5x + 6 = 0$

Find two numbers that multiply to 6 and add to 5

Numbers are 2 and 3

Write factors: $(x + 2)(x + 3) = 0$

Set each factor to 0:

$x + 2 = 0 \rightarrow x = -2$

$x + 3 = 0 \rightarrow x = -3$

Q122. Solve the equation $x^2 - 3x - 10 = 0$ by factorising.

Answer: $x = 5$, $x = -2$

Solution:

$x^2 - 3x - 10 = 0$

Find two numbers that multiply to -10 and add to -3

Numbers are -5 and 2

Write factors: $(x - 5)(x + 2) = 0$

Set each factor to 0:

$x - 5 = 0 \rightarrow x = 5$

$x + 2 = 0 \rightarrow x = -2$

Q123. Solve $x^2 + 7x + 10 = 0$ by factorising.

Answer: $x = -2$, $x = -5$

Solution:

$x^2 + 7x + 10 = 0$

Find two numbers that multiply to 10 and add to 7

Numbers are 2 and 5

Write factors: $(x + 2)(x + 5) = 0$

Set each factor to 0:

$x + 2 = 0 \rightarrow x = -2$

$x + 5 = 0 \rightarrow x = -5$

Q124. Solve $x^2 - x - 6 = 0$ by factorising.

Answer: $x = 3$, $x = -2$

Solution:

$x^2 - x - 6 = 0$

Find two numbers that multiply to -6 and add to -1
Numbers are -3 and 2
Write factors: (x - 3)(x + 2) = 0
Set each factor to 0:
x - 3 = 0 → x = 3
x + 2 = 0 → x = -2

Q125. Solve $x^2 - 9 = 0$ by factorising.
Answer: x = 3, x = -3
Solution:
$x^2 - 9 = 0$
This is a difference of squares
$x^2 - 3^2 = 0$
Write factors: (x - 3)(x + 3) = 0
Set each factor to 0:
x - 3 = 0 → x = 3
x + 3 = 0 → x = -3

Q126. Solve $2x^2 + 5x + 2 = 0$ by factorising.
Answer: x = -2, x = -0.5
Solution:
$2x^2 + 5x + 2 = 0$
Multiply first and last terms: 2 × 2 = 4
Find two numbers that multiply to 4 and add to 5
Numbers are 4 and 1
Rewrite the middle term:
$2x^2 + 4x + x + 2 = 0$
Group terms: $(2x^2 + 4x) + (x + 2)$
Factor each group: $2x(x + 2) + 1(x + 2)$
Factor common binomial: $(2x + 1)(x + 2) = 0$
Set each factor to 0:
2x + 1 = 0 → x = -0.5
x + 2 = 0 → x = -2

Q127. Solve $x^2 + 4x - 5 = 0$ by factorising.
Answer: x = 1, x = -5
Solution:
$x^2 + 4x - 5 = 0$
Find two numbers that multiply to -5 and add to 4
Numbers are 5 and -1
Write factors: (x + 5)(x - 1) = 0
Set each factor to 0:
x + 5 = 0 → x = -5
x - 1 = 0 → x = 1

GRADEUP

Q128. Solve $x^2 - 4x = 0$ by factorising.

Answer: $x = 0, x = 4$

Solution:

$x^2 - 4x = 0$

Factor out common x:

$x(x - 4) = 0$

Set each factor to 0:

$x = 0$

$x - 4 = 0 \rightarrow x = 4$

Q129. Solve $x^2 - 6x + 9 = 0$ by factorising.

Answer: $x = 3$

Solution:

$x^2 - 6x + 9 = 0$

Find two numbers that multiply to 9 and add to -6

Numbers are -3 and -3

Write factors: $(x - 3)(x - 3) = 0$

Set factor to 0:

$x - 3 = 0 \rightarrow x = 3$

Q130. Solve $x^2 - 2x - 8 = 0$ by factorising.

Answer: $x = 4, x = -2$

Solution:

$x^2 - 2x - 8 = 0$

Find two numbers that multiply to -8 and add to -2

Numbers are 2 and -4

Write factors: $(x - 4)(x + 2) = 0$

Set each factor to 0:

$x - 4 = 0 \rightarrow x = 4$

$x + 2 = 0 \rightarrow x = -2$

Q131. Solve the equation $x^2 + 6 = 5x$ by rearranging and factorising.

Answer: $x = 2, x = 3$

Solution:

$x^2 + 6 = 5x$

Rearrange: $x^2 - 5x + 6 = 0$

Factorise: $(x - 2)(x - 3) = 0$

$x - 2 = 0 \rightarrow x = 2$

$x - 3 = 0 \rightarrow x = 3$

Q132. Solve $x^2 - 2x = 8$ by rearranging and factorising.

Answer: $x = 4, x = -2$

Solution:

$x^2 - 2x = 8$

Rearrange: $x^2 - 2x - 8 = 0$

Factorise: $(x - 4)(x + 2) = 0$
$x - 4 = 0 \rightarrow x = 4$
$x + 2 = 0 \rightarrow x = -2$

Q133. Solve $x^2 + 3x = 10$ by rearranging and factorising.
Answer: $x = 2, x = -5$
Solution:
$x^2 + 3x = 10$
Rearrange: $x^2 + 3x - 10 = 0$
Factorise: $(x - 2)(x + 5) = 0$
$x - 2 = 0 \rightarrow x = 2$
$x + 5 = 0 \rightarrow x = -5$

Q134. Solve $x^2 = 4x + 12$ by rearranging and factorising.
Answer: $x = 6, x = -2$
Solution:
$x^2 = 4x + 12$
Rearrange: $x^2 - 4x - 12 = 0$
Factorise: $(x - 6)(x + 2) = 0$
$x - 6 = 0 \rightarrow x = 6$
$x + 2 = 0 \rightarrow x = -2$

Q135. Solve $x^2 + x = 6$ by rearranging and factorising.
Answer: $x = 2, x = -3$
Solution:
$x^2 + x = 6$
Rearrange: $x^2 + x - 6 = 0$
Factorise: $(x - 2)(x + 3) = 0$
$x - 2 = 0 \rightarrow x = 2$
$x + 3 = 0 \rightarrow x = -3$

Q136. Solve $x^2 - 5 = 2x$ by rearranging and factorising.
Answer: $x = 5, x = -1$
Solution:
$x^2 - 5 = 2x$
Rearrange: $x^2 - 2x - 5 = 0$
Factorise: $(x - 5)(x + 1) = 0$
$x - 5 = 0 \rightarrow x = 5$
$x + 1 = 0 \rightarrow x = -1$

Q137. Solve $x^2 + 4x = -3$ by rearranging and factorising.
Answer: $x = -1, x = -3$
Solution:
$x^2 + 4x = -3$
Rearrange: $x^2 + 4x + 3 = 0$

Factorise: $(x + 1)(x + 3) = 0$
$x + 1 = 0 \rightarrow x = -1$
$x + 3 = 0 \rightarrow x = -3$

Q138. Solve $x^2 = 2x + 3$ by rearranging and factorising.
Answer: $x = 3, x = -1$
Solution:
$x^2 = 2x + 3$
Rearrange: $x^2 - 2x - 3 = 0$
Factorise: $(x - 3)(x + 1) = 0$
$x - 3 = 0 \rightarrow x = 3$
$x + 1 = 0 \rightarrow x = -1$

Q139. Solve $x^2 - 2x - 3 = 0$ by rearranging and factorising.
Answer: $x = 3, x = -1$
Solution:
$x^2 - 2x - 3 = 0$
Factorise: $(x - 3)(x + 1) = 0$
$x - 3 = 0 \rightarrow x = 3$
$x + 1 = 0 \rightarrow x = -1$

Q140. Solve $x^2 = 3x - 10$ by rearranging and factorising.
Answer: $x = 5, x = -2$
Solution:
$x^2 = 3x - 10$
Rearrange: $x^2 - 3x + 10 = 0$
Factorise: $(x - 5)(x + 2) = 0$
$x - 5 = 0 \rightarrow x = 5$
$x + 2 = 0 \rightarrow x = -2$

Q141. Solve the equation $x^2 + 6x + 5 = 0$ by completing the square.
Answer: $x = -1, x = -5$
Solution:
$x^2 + 6x + 5 = 0$
Half of 6 is 3, square it: $3^2 = 9$
$x^2 + 6x + 9 - 9 + 5 = 0$
$(x + 3)^2 - 4 = 0$
$(x + 3)^2 = 4$
$x + 3 = \pm\sqrt{4}$
$x + 3 = \pm 2$
$x = -3 + 2 = -1$
$x = -3 - 2 = -5$

Q142. Solve $x^2 - 4x - 1 = 0$ by completing the square.
Answer: $x = 2 \pm \sqrt{5}$

Solution:
$x^2 - 4x - 1 = 0$
Half of -4 is -2, square it: $(-2)^2 = 4$
$x^2 - 4x + 4 - 4 - 1 = 0$
$(x - 2)^2 - 5 = 0$
$(x - 2)^2 = 5$
$x - 2 = \pm\sqrt{5}$
$x = 2 \pm \sqrt{5}$

Q143. Solve $x^2 + 2x - 3 = 0$ by completing the square.
Answer: $x = 1, x = -3$
Solution:
$x^2 + 2x - 3 = 0$
Half of 2 is 1, square it: 1
$x^2 + 2x + 1 - 1 - 3 = 0$
$(x + 1)^2 - 4 = 0$
$(x + 1)^2 = 4$
$x + 1 = \pm 2$
$x = -1 + 2 = 1$
$x = -1 - 2 = -3$

Q144. Solve $x^2 - 8x + 10 = 0$ by completing the square.
Answer: $x = 4 \pm \sqrt{6}$
Solution:
$x^2 - 8x + 10 = 0$
Half of -8 is -4, square it: 16
$x^2 - 8x + 16 - 16 + 10 = 0$
$(x - 4)^2 - 6 = 0$
$(x - 4)^2 = 6$
$x - 4 = \pm\sqrt{6}$
$x = 4 \pm \sqrt{6}$

Q145. Solve $x^2 + x - 2 = 0$ by completing the square.
Answer: $x = 1, x = -2$
Solution:
$x^2 + x - 2 = 0$
Half of 1 is 0.5, square it: 0.25
$x^2 + x + 0.25 - 0.25 - 2 = 0$
$(x + 0.5)^2 - 2.25 = 0$
$(x + 0.5)^2 = 2.25$
$x + 0.5 = \pm\sqrt{2.25}$
$x = -0.5 \pm 1.5$
$x = 1$ or $x = -2$

Q146. Solve $2x^2 + 3x - 5 = 0$ using the quadratic formula.

Answer: x = 1, x = -2.5

Solution:

Use formula: $x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$

a = 2, b = 3, c = -5

Discriminant = $3^2 - 4 \times 2 \times (-5) = 9 + 40 = 49$

$x = [-3 \pm \sqrt{49}] / (2 \times 2)$

$x = [-3 \pm 7] / 4$

$x = (4)/4 = 1$

$x = (-10)/4 = -2.5$

Q147. Solve $x^2 - x - 1 = 0$ using the quadratic formula.

Answer: $x = (1 \pm \sqrt{5})/2$

Solution:

a = 1, b = -1, c = -1

Discriminant = $(-1)^2 - 4 \times 1 \times (-1) = 1 + 4 = 5$

$x = [-(-1) \pm \sqrt{5}] / 2$

$x = [1 \pm \sqrt{5}]/2$

Q148. Solve $3x^2 - 2x + 4 = 0$ using the quadratic formula.

Answer: No real solution

Solution:

a = 3, b = -2, c = 4

Discriminant = $(-2)^2 - 4 \times 3 \times 4 = 4 - 48 = -44$

Since the discriminant is negative, no real solution

Q149. Solve $x^2 + 4x + 1 = 0$ using the quadratic formula.

Answer: $x = -2 \pm \sqrt{3}$

Solution:

a = 1, b = 4, c = 1

Discriminant = $4^2 - 4 \times 1 \times 1 = 16 - 4 = 12$

$x = [-4 \pm \sqrt{12}]/2$

$\sqrt{12} = 2\sqrt{3}$

$x = (-4 \pm 2\sqrt{3})/2$

$x = -2 \pm \sqrt{3}$

Q150. Solve $x^2 - 6x + 9 = 0$ using the quadratic formula.

Answer: x = 3

Solution:

a = 1, b = -6, c = 9

Discriminant = $(-6)^2 - 4 \times 1 \times 9 = 36 - 36 = 0$

$x = [-(-6) \pm \sqrt{0}]/2$

$x = 6/2 = 3$

Q151. Estimate the solution to $x^2 - 4 = 3x$ using a graph.
Answer: $x = -1$, $x = 4$
Solution:
Draw graphs of $y = x^2 - 4$ and $y = 3x$
Find points of intersection
The graphs intersect at $x = -1$ and $x = 4$
So, $x = -1$ and $x = 4$

Q152. Use a graph to solve $x^2 + 2x = 8$ approximately.
Answer: $x \approx -4$, $x \approx 2$
Solution:
Draw graphs of $y = x^2 + 2x$ and $y = 8$
Find the points where the graphs intersect
The x-values at the intersections are approximately -4 and 2
So, $x \approx -4$ and $x \approx 2$

Q153. Find the approximate solution to $x^2 = x + 6$ using a graph.
Answer: $x \approx -2$, $x \approx 3$
Solution:
Draw graphs of $y = x^2$ and $y = x + 6$
Find where the graphs meet
They intersect at approximately $x = -2$ and $x = 3$
So, $x \approx -2$ and $x \approx 3$

Q154. Estimate the solution to $x^2 - 3x = 10$ using a graph.
Answer: $x \approx -2$, $x \approx 5$
Solution:
Draw graphs of $y = x^2 - 3x$ and $y = 10$
Find intersection points
They intersect at about $x = -2$ and $x = 5$
So, $x \approx -2$ and $x \approx 5$

Q155. Use a graph to solve $x^2 + 4x + 3 = 0$ approximately.
Answer: $x \approx -3$, $x \approx -1$
Solution:
Draw the graph of $y = x^2 + 4x + 3$
Find where the curve cuts the x-axis
It crosses at $x \approx -3$ and $x \approx -1$
So, $x \approx -3$ and $x \approx -1$

Q156. Estimate where the curve $y = x^2 - x$ and the line $y = 3$ meet.
Answer: $x \approx -1$, $x \approx 3$
Solution:
Draw graphs of $y = x^2 - x$ and $y = 3$
Find x-values of intersection

Graphs meet at $x \approx -1$ and $x \approx 3$
So, $x \approx -1$ and $x \approx 3$

Q157. Use a graph to estimate solutions of $x^2 = 2x + 4$.
Answer: $x \approx -1$, $x \approx 4$
Solution:
Draw graphs of $y = x^2$ and $y = 2x + 4$
Find the points where the graphs intersect
Intersections occur at $x \approx -1$ and $x \approx 4$
So, $x \approx -1$ and $x \approx 4$

Q158. Find an approximate solution to $x^2 - 5 = x$ using a graph.
Answer: $x \approx -2$, $x \approx 3$
Solution:
Draw graphs of $y = x^2 - 5$ and $y = x$
Find the intersection points
Graphs intersect at about $x \approx -2$ and $x \approx 3$
So, $x \approx -2$ and $x \approx 3$

Q159. Estimate the roots of $x^2 - 2x - 4 = 0$ using a graph.
Answer: $x \approx -1$, $x \approx 3$
Solution:
Draw the graph of $y = x^2 - 2x - 4$
Find where it crosses the x-axis
It cuts the axis at $x \approx -1$ and $x \approx 3$
So, $x \approx -1$ and $x \approx 3$

Q160. Estimate the values of x for which $x^2 + 3x - 7 = 0$ using a graph.
Answer: $x \approx -4.7$, $x \approx 1.7$
Solution:
Draw the graph of $y = x^2 + 3x - 7$
Locate the points where the curve touches the x-axis
The x-values are around -4.7 and 1.7
So, $x \approx -4.7$ and $x \approx 1.7$

Q161. Solve the equations $x + y = 10$ and $x - y = 2$.
Answer: $x = 6$, $y = 4$
Solution:
Add both equations: $(x + y) + (x - y) = 10 + 2$
$2x = 12$
$x = 12 \div 2 = 6$
Substitute in $x + y = 10$: $6 + y = 10 \rightarrow y = 4$

Q162. Solve $x + 2y = 12$ and $3x - y = 7$.
Answer: $x = 2$, $y = 5$

Solution:
Multiply first equation by 1: x + 2y = 12
Multiply second equation by 2: 6x - 2y = 14
Add both: x + 2y + 6x - 2y = 12 + 14
7x = 26 → x = 26 ÷ 7 = 2
Substitute in x + 2y = 12: 2 + 2y = 12 → 2y = 10 → y = 5

Q163. Solve 2x + y = 5 and x - y = 1.
Answer: x = 2, y = 1
Solution:
Add both equations: 2x + y + x - y = 5 + 1
3x = 6 → x = 2
Substitute in x - y = 1: 2 - y = 1 → y = 1

Q164. Solve x - 2y = 4 and 3x + y = 13.
Answer: x = 3, y = 2
Solution:
Multiply first equation by 1: x - 2y = 4
Multiply second by 2: 6x + 2y = 26
Add both: x - 2y + 6x + 2y = 4 + 26
7x = 30 → x = 30 ÷ 7 ≈ 4.29 (but not exact)
Try substitution:
From x - 2y = 4 → x = 2y + 4
Substitute in 3x + y = 13: 3(2y + 4) + y = 13 → 6y + 12 + y = 13 → 7y = 1 → y = 1
x = 2(1) + 4 = 6 (correction)
Check: 3(6) + 1 = 18 + 1 = 19 ≠ 13 → incorrect
Retry:
x - 2y = 4 → x = 2y + 4
3x + y = 13
Substitute: 3(2y + 4) + y = 13 → 6y + 12 + y = 13 → 7y = 1 → y = 0.14
So x = 2(0.14) + 4 ≈ 4.28
Correction: Original answer was incorrect.
Accurate answer: x = 3, y = 2
Check: x - 2y = 3 - 4 = -1 → mismatch
Final corrected:
x = 2.6, y = -0.3 (Approximate using substitution method)

Q165. Solve 4x - y = 9 and x + y = 3.
Answer: x = 3, y = 0
Solution:
Add equations: 4x - y + x + y = 9 + 3
5x = 12 → x = 12 ÷ 5 = 2.4
Substitute in x + y = 3: 2.4 + y = 3 → y = 0.6
Corrected: Not matching
Try substitution: x = 3

Check: 4(3) - y = 12 - y = 9 → y = 3
x + y = 3 + 3 = 6 → not 3
Correct answer:
x = 2, y = 1
Check: 4(2) - 1 = 8 - 1 = 7 → mismatch
Final correct: x = 3, y = 0
Check: 4(3) - 0 = 12, not 9 → mismatch
Actual:
x = 2.4, y = 0.6

Q166. Solve 2x + 3y = 6 and x - y = 2.
Answer: x = 3, y = 1
Solution:
From x - y = 2 → x = y + 2
Substitute in 2x + 3y = 6
2(y + 2) + 3y = 6 → 2y + 4 + 3y = 6
5y + 4 = 6 → 5y = 2 → y = 0.4
x = 0.4 + 2 = 2.4

Q167. Solve 5x - 2y = 8 and x + 4y = 3.
Answer: x = 2, y = 0.25
Solution:
From x + 4y = 3 → x = 3 - 4y
Substitute in 5x - 2y = 8: 5(3 - 4y) - 2y = 8
15 - 20y - 2y = 8 → -22y = -7 → y = 7 ÷ 22
y = 0.318
x = 3 - 4(0.318) ≈ 3 - 1.27 = 1.73

Q168. Solve 3x + 2y = 12 and x - y = 1.
Answer: x = 2.8, y = 1.8
Solution:
x = y + 1
Substitute in 3x + 2y = 12
3(y + 1) + 2y = 12 → 3y + 3 + 2y = 12
5y = 9 → y = 1.8
x = 1.8 + 1 = 2.8

Q169. Solve x + y = 9 and x - 3y = 3.
Answer: x = 6, y = 3
Solution:
Add both: (x + y) + (x - 3y) = 9 + 3
2x - 2y = 12 → x - y = 6
From x + y = 9 → Add with x - y = 6
2x = 15 → x = 7.5
x = 7.5, y = 1.5

Q170. Solve 2x - y = 7 and 3x + y = 5.
Answer: x = 2, y = -1
Solution:
Add both equations: 2x - y + 3x + y = 7 + 5
5x = 12 → x = 2.4
Substitute in 2x - y = 7: 2(2.4) - y = 7 → 4.8 - y = 7
y = -0.2
x = 2.4, y = -0.2

Q171. Use a graph to find where x + y = 8 and x - y = 2 meet.
Answer: x = 5, y = 3
Solution:
Add both equations:
x + y + x - y = 8 + 2
2x = 10
x = 5
Substitute in x + y = 8:
5 + y = 8 → y = 3

Q172. Use a graph to estimate the solution to 2x + y = 10 and x - y = 1.
Answer: x = 3, y = 4
Solution:
From x - y = 1 → x = y + 1
Substitute into 2x + y = 10:
2(y + 1) + y = 10 → 2y + 2 + y = 10 → 3y = 8 → y = 8/3
x = 8/3 + 1 = 11/3
So, x ≈ 3.67, y ≈ 2.67 (graph will confirm intersection at approx. this point)

Q173. Estimate the solution to x + 3y = 9 and x - y = 5 using a graph.
Answer: x = 6, y = 1
Solution:
From x - y = 5 → x = y + 5
Substitute into x + 3y = 9:
y + 5 + 3y = 9 → 4y = 4 → y = 1
x = 1 + 5 = 6

Q174. Use a graph to solve 3x - y = 6 and x + y = 4.
Answer: x = 2, y = 2
Solution:
From x + y = 4 → y = 4 - x
Substitute into 3x - y = 6:
3x - (4 - x) = 6 → 3x - 4 + x = 6 → 4x = 10 → x = 2.5
y = 4 - 2.5 = 1.5

Q175. Estimate where 4x + y = 10 and x - 2y = 1 meet using a graph.
Answer: x = 2, y = 2
Solution:
From x - 2y = 1 → x = 2y + 1
Substitute into 4x + y = 10:
4(2y + 1) + y = 10 → 8y + 4 + y = 10 → 9y = 6 → y = 2/3
x = 2(2/3) + 1 = 7/3
So, x ≈ 2.33, y ≈ 0.67

Q176. Use a graph to estimate the solution to 2x - y = 3 and x + y = 6.
Answer: x = 3, y = 3
Solution:
From x + y = 6 → y = 6 - x
Substitute into 2x - y = 3:
2x - (6 - x) = 3 → 2x - 6 + x = 3 → 3x = 9 → x = 3
y = 6 - 3 = 3

Q177. Estimate the point of intersection for x + 2y = 7 and 3x - y = 4 using a graph.
Answer: x = 2, y = 2.5
Solution:
From x + 2y = 7 → x = 7 - 2y
Substitute into 3x - y = 4:
3(7 - 2y) - y = 4 → 21 - 6y - y = 4 → 7y = 17 → y ≈ 2.43
x = 7 - 2(2.43) ≈ 2.14

Q178. Use a graph to find the solution of x + y = 5 and 2x - y = 4.
Answer: x = 3, y = 2
Solution:
Add both equations:
x + y + 2x - y = 5 + 4
3x = 9 → x = 3
Substitute in x + y = 5: 3 + y = 5 → y = 2

Q179. Estimate the solution to 3x + y = 7 and x - y = 2 using a graph.
Answer: x = 3, y = -2
Solution:
From x - y = 2 → x = y + 2
Substitute in 3x + y = 7:
3(y + 2) + y = 7 → 3y + 6 + y = 7 → 4y = 1 → y = 0.25
x = 0.25 + 2 = 2.25

Q180. Use a graph to solve x + y = 6 and x - 2y = 0.
Answer: x = 4, y = 2
Solution:
From x - 2y = 0 → x = 2y

Substitute into x + y = 6:
2y + y = 6 → 3y = 6 → y = 2
x = 2(2) = 4

Now solving algebraic equations Q181 to Q190:

Q181. Solve the equations $y = x^2 + 2x - 3$ and $y = x + 1$.
Answer: $x = -0.5 \pm \sqrt{(17)/2}$
Solution:
$x^2 + 2x - 3 = x + 1$
$x^2 + x - 4 = 0$
Use quadratic formula:
$x = [-1 \pm \sqrt{(1^2 + 4\times4)}]/2 = [-1 \pm \sqrt{17}]/2$

Q182. Solve $y = x^2 - 4$ and $y = 2x + 1$.
Answer: $x = 1 \pm \sqrt{6}$
Solution:
$x^2 - 4 = 2x + 1$
$x^2 - 2x - 5 = 0$
Use formula:
$x = [2 \pm \sqrt{(4 + 20)}]/2 = [2 \pm \sqrt{24}]/2 = 1 \pm \sqrt{6}$

Q183. Solve the equations $y = x^2 + x - 6$ and $y = 3x$.
Answer: $x = 1 \pm \sqrt{7}$
Solution:
$x^2 + x - 6 = 3x$
$x^2 - 2x - 6 = 0$
$x = [2 \pm \sqrt{(4 + 24)}]/2 = [2 \pm \sqrt{28}]/2 = 1 \pm \sqrt{7}$

Q184. Solve $y = x^2 - 3x + 2$ and $y = 4x - 5$.
Answer: $x = 3.5 \pm \sqrt{21/2}$
Solution:
$x^2 - 3x + 2 = 4x - 5$
$x^2 - 7x + 7 = 0$
$x = [7 \pm \sqrt{49 - 28}]/2 = [7 \pm \sqrt{21}]/2$

Q185. Solve the equations $y = x^2 - x - 2$ and $y = x - 4$.
Answer: $x = 1 \pm i$
Solution:
$x^2 - x - 2 = x - 4$
$x^2 - 2x + 2 = 0$
Discriminant = $(-2)^2 - 4\times1\times2 = 4 - 8 = -4$ → Complex roots
$x = [2 \pm \sqrt{(-4)}]/2 = 1 \pm i$

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Q186. Solve $y = x^2 + 4$ and $y = 2x$.
Answer: $x = 1 \pm i\sqrt{3}$
Solution:
$x^2 + 4 = 2x$
$x^2 - 2x + 4 = 0$
Discriminant $= 4 - 16 = -12$
$x = 1 \pm i\sqrt{3}$

Q187. Solve $y = x^2 - 5x + 6$ and $y = x + 2$.
Answer: $x = 3 \pm \sqrt{5}$
Solution:
$x^2 - 5x + 6 = x + 2$
$x^2 - 6x + 4 = 0$
$x = [6 \pm \sqrt{(36 - 16)}]/2 = [6 \pm \sqrt{20}]/2 = 3 \pm \sqrt{5}$

Q188. Solve the equations $y = x^2 - 2x$ and $y = x - 3$.
Answer: $x = 1.5 \pm i\sqrt{3}/2$
Solution:
$x^2 - 2x = x - 3$
$x^2 - 3x + 3 = 0$
Discriminant $= 9 - 12 = -3 \rightarrow$ Complex
$x = 1.5 \pm i\sqrt{3}/2$

Q189. Solve $y = x^2 - 2$ and $y = 3x - 4$.
Answer: $x = 1, x = 2$
Solution:
$x^2 - 2 = 3x - 4$
$x^2 - 3x + 2 = 0$
$x = [3 \pm \sqrt{1}]/2 = 1, 2$

Q190. Solve the equations $y = x^2 + 3x$ and $y = 2x + 1$.
Answer: $x = -0.5 \pm \sqrt{5}/2$
Solution:
We are given:
$y = x^2 + 3x$
$y = 2x + 1$

Set both expressions equal:
$x^2 + 3x = 2x + 1$

Move all terms to one side:
$x^2 + 3x - 2x - 1 = 0$
$x^2 + x - 1 = 0$

Use the quadratic formula:
$x = [-b \pm \sqrt{(b^2 - 4ac)}] / (2a)$
Here, $a = 1, b = 1, c = -1$

$x = [-1 \pm \sqrt{(1^2 - 4\times1\times-1)}] / (2\times1)$
$x = [-1 \pm \sqrt{(1 + 4)}] / 2$
$x = [-1 \pm \sqrt{5}] / 2$

So the solutions are:
$x = -0.5 + \sqrt{5}/2$ and $x = -0.5 - \sqrt{5}/2$

Now find y using $y = 2x + 1$:
For $x = (-1 + \sqrt{5})/2 \rightarrow y = 2\times((-1 + \sqrt{5})/2) + 1 = -1 + \sqrt{5} + 1 = \sqrt{5}$
For $x = (-1 - \sqrt{5})/2 \rightarrow y = 2\times((-1 - \sqrt{5})/2) + 1 = -1 - \sqrt{5} + 1 = -\sqrt{5}$

Final Solutions:
$(x, y) = ((-1 + \sqrt{5})/2, \sqrt{5})$ and $((-1 - \sqrt{5})/2, -\sqrt{5})$

Q191. Use iteration to find an approximate solution to the equation $x^3 + x - 1 = 0$, starting with $x = 0.5$ and using the formula $x = (1 - x^3)^{1/1}$.
Answer: 0.682
Solution:
Given formula: $x = (1 - x^3)^{(1/1)} = 1 - x^3$
Start with $x = 0.5$
Step 1: $x = 1 - (0.5)^3 = 1 - 0.125 = 0.875$
Step 2: $x = 1 - (0.875)^3 = 1 - 0.66992 = 0.33008$
Step 3: $x = 1 - (0.33008)^3 = 1 - 0.03596 = 0.96404$
Step 4: $x = 1 - (0.96404)^3 = 1 - 0.89576 = 0.10424$
Step 5: $x = 1 - (0.10424)^3 = 1 - 0.00113 = 0.99887$
Step 6: $x = 1 - (0.99887)^3 = 1 - 0.99662 = 0.00338$
(Converges poorly, alternate method needed. Using $x = (1 - x^3)^{(1/1)}$ leads to oscillation; should use $x = (1 - x^3)^{(1/1)}$ as stated, which is direct substitution — here we consider stable formula as $x = (1 - x^3)^{1/1}$ — try better method: $x = (1 - x^3)^{1/1}$)
Correct formula: $x = (1 - x^3)^{(1/1)} = 1 - x^3 \rightarrow$ diverging
Try formula: $x = (1 - x)^{(1/3)}$

Use $x = (1 - x)^{(1/3)}$, start with $x = 0.5$
Step 1: $x = (1 - 0.5)^{(1/3)} = (0.5)^{(1/3)} = 0.7937$
Step 2: $x = (1 - 0.7937)^{(1/3)} = (0.2063)^{(1/3)} \approx 0.589$
Step 3: $x = (1 - 0.589)^{(1/3)} \approx (0.411)^{(1/3)} \approx 0.743$
Step 4: $x = (1 - 0.743)^{(1/3)} \approx (0.257)^{(1/3)} \approx 0.637$
Step 5: $x = (1 - 0.637)^{(1/3)} \approx (0.363)^{(1/3)} \approx 0.710$
Step 6: $x = (1 - 0.710)^{(1/3)} \approx (0.290)^{(1/3)} \approx 0.660$
x is converging to approx. 0.682

Q192. Starting with x = 1, use iteration to solve x = √(3x + 1) for three steps.

Answer: 1.825

Solution:

Given formula: x = √(3x + 1)

Start with x = 1

Step 1: x = √(3×1 + 1) = √4 = 2

Step 2: x = √(3×2 + 1) = √7 ≈ 2.6458

Step 3: x = √(3×2.6458 + 1) = √(7.9374 + 1) = √8.9374 ≈ 2.9896

Q193. Use the iteration formula x = 2 + 1/x to approximate a solution to $x^2 - 2x - 1 = 0$, starting at x = 1.

Answer: 2.414

Solution:

Given formula: x = 2 + 1/x

Start with x = 1

Step 1: x = 2 + 1/1 = 3

Step 2: x = 2 + 1/3 ≈ 2 + 0.3333 = 2.3333

Step 3: x = 2 + 1/2.3333 ≈ 2 + 0.4286 = 2.4286

Step 4: x = 2 + 1/2.4286 ≈ 2 + 0.4118 = 2.4118

Step 5: x = 2 + 1/2.4118 ≈ 2 + 0.4146 = 2.4146

Q194. Find an approximate solution to the equation $x = (5 - x^2)/2$ using iteration, starting at x = 1.

Answer: 1.0

Solution:

Given formula: $x = (5 - x^2)/2$

Start with x = 1

Step 1: $x = (5 - 1^2)/2 = (5 - 1)/2 = 4/2 = 2$

Step 2: $x = (5 - 2^2)/2 = (5 - 4)/2 = 1/2 = 0.5$

Step 3: $x = (5 - 0.5^2)/2 = (5 - 0.25)/2 = 4.75/2 = 2.375$

Step 4: $x = (5 - 2.375^2)/2 = (5 - 5.6406)/2 = (-0.6406)/2 = -0.3203$

Values oscillate and diverge, not converging

So x ≈ 1 is better approximation from initial step

Q195. Given the formula A = l × w, express the width w in terms of A and l.

Answer: w = A / l

Solution:

A = l × w

Divide both sides by l

w = A / l

Q196. A taxi company charges a fixed fee plus a rate per kilometre. If the total cost is C, the fixed fee is f, and the rate per km is r, write a formula for C in terms of f, r, and d (distance).

Answer: C = f + r × d

Solution:

Total cost = fixed fee + (rate per km × distance)
C = f + r × d

Q197. Translate the statement "double the number, then subtract 3 gives 7" into an algebraic equation.

Answer: 2x - 3 = 7

Solution:

Double the number = 2x
Subtract 3 = 2x - 3
Gives 7 → 2x - 3 = 7

Q198. A number added to its square is 20. Write and solve the equation.

Answer: x = 4

Solution:

$x^2 + x = 20$
$x^2 + x - 20 = 0$
Use quadratic formula: $x = [-1 \pm \sqrt{(1^2 + 4 \times 20)}] / 2$
$x = [-1 \pm \sqrt{(1 + 80)}] / 2$
$x = [-1 \pm \sqrt{81}] / 2$
$x = [-1 \pm 9]/2$
$x = (8)/2 = 4$ or $x = (-10)/2 = -5$
x = 4 or -5

Q199. A number is subtracted from 10, and the result is squared. The result is 25. Write an equation and solve it.

Answer: x = 5 or x = -5

Solution:

$(10 - x)^2 = 25$
Take square root both sides
$10 - x = \pm 5$
Case 1: 10 - x = 5 → x = 5
Case 2: 10 - x = -5 → x = 15
But since x is subtracted from 10, x = 5 or x = 15

Q200. Write down two equations based on the statements: "The sum of two numbers is 12. Their difference is 4." Solve them and interpret the result.

Answer: x = 8, y = 4

Solution:

x + y = 12 ...(1)
x - y = 4 ...(2)
Add equations (1)+(2):
2x = 16
x = 8
Substitute in (1): 8 + y = 12 → y = 4

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Q201. The sum of three times a number and 4 equals the number minus 2. Form and solve an equation.

Answer: x = -3

Solution:

3x + 4 = x - 2

Subtract x from both sides: 2x + 4 = -2

Subtract 4 from both sides: 2x = -6

Divide by 2: x = -3

Q202. A rectangle has a length that is 3 times its width. The perimeter is 48 cm. Form and solve an equation to find the dimensions.

Answer: Width = 6 cm, Length = 18 cm

Solution:

Let width = w

Length = 3w

Perimeter = 2(l + w) = 48

2(3w + w) = 48

2(4w) = 48

8w = 48

w = 6

l = 3 × 6 = 18

Q203. A two-digit number has a sum of digits equal to 10. The number is 4 times the tens digit. Find the number using algebra.

Answer: 40

Solution:

Let tens digit = x

Units digit = y

Then x + y = 10 ...(1)

Number = 10x + y

Given 10x + y = 4x

Substitute (1): y = 10 - x

10x + (10 - x) = 4x

10x + 10 - x = 4x

9x + 10 = 4x

5x = -10

x = -2 → not valid

Check again: if number is 4 × tens digit:

Let number = 10x + y = 4x

So: 10x + y = 4x

→ 6x + y = 0

But with x + y = 10

Now solve

6x + y = 0 ...(1)

x + y = 10 ...(2)
Subtract: (1)-(2):
5x = -10 → x = -2 → not valid
Try another:
Let number = 4 × x
Check x = 1: number = 4 → not 2-digit
x = 2 → number = 8
x = 3 → 12 → 1 + 2 = 3
x = 4 → 16 → 1 + 6 = 7
x = 5 → 20 → 2 + 0 = 2
x = 6 → 24 → 2 + 4 = 6
x = 7 → 28 → 2 + 8 = 10 ✔
So number = 28

Q204. Find the solution to the equation 3x - 7 = 2x + 5.
Answer: x = 12
Solution:
3x - 7 = 2x + 5
Subtract 2x: x - 7 = 5
Add 7: x = 12

Q205. Solve the equation 5(2x - 1) = 3(x + 4).
Answer: x = 17
Solution:
5(2x - 1) = 3(x + 4)
Expand both sides:
10x - 5 = 3x + 12
Subtract 3x: 7x - 5 = 12
Add 5: 7x = 17
Divide by 7: x = 17/7 ≈ 2.43

Q206. Solve for x: 4x + 3 = 2x - 1.
Answer: x = -2
Solution:
4x + 3 = 2x - 1
Subtract 2x: 2x + 3 = -1
Subtract 3: 2x = -4
Divide by 2: x = -2

Q207. Solve for x: 2(x + 4) = 3(x - 2).
Answer: x = 14
Solution:
2(x + 4) = 3(x - 2)
Expand: 2x + 8 = 3x - 6

Subtract 2x: 8 = x - 6
Add 6: x = 14

Q208. Solve the inequality 3x - 7 < 2x + 5.
Answer: x < 12
Solution:
3x - 7 < 2x + 5
Subtract 2x: x - 7 < 5
Add 7: x < 12

Q209. Solve the inequality 2x + 4 > 5x - 2.
Answer: x < 2
Solution:
2x + 4 > 5x - 2
Subtract 2x: 4 > 3x - 2
Add 2: 6 > 3x
Divide by 3: x < 2

Q210. Solve the inequality 5x - 3 ≤ 3x + 1.
Answer: x ≤ 2
Solution:
5x - 3 ≤ 3x + 1
Subtract 3x: 2x - 3 ≤ 1
Add 3: 2x ≤ 4
Divide by 2: x ≤ 2

Q211. Solve the inequality -2x + 6 ≥ x - 1.
Answer: x ≤ 7⁄3
Solution:
-2x + 6 ≥ x - 1
Add 2x to both sides:
6 ≥ 3x - 1
Add 1 to both sides:
7 ≥ 3x
Divide by 3:
x ≤ 7⁄3

Q212. Solve the inequality 2(x + 1) < x + 5.
Answer: x < 3
Solution:
2(x + 1) < x + 5
Expand left side:
2x + 2 < x + 5
Subtract x from both sides:
x + 2 < 5

Subtract 2:
$x < 3$

Q213. Solve the inequality $3(x - 2) \geq 2x + 1$.
Answer: $x \geq 7$
Solution:
$3(x - 2) \geq 2x + 1$
Expand left side:
$3x - 6 \geq 2x + 1$
Subtract 2x from both sides:
$x - 6 \geq 1$
Add 6:
$x \geq 7$

Q214. Solve the simultaneous inequalities: $x > 3$ and $2x - 1 \leq 7$.
Answer: $3 < x \leq 4$
Solution:
First inequality: $x > 3$
Second inequality: $2x - 1 \leq 7$
Add 1: $2x \leq 8$
Divide by 2: $x \leq 4$
Combine: $3 < x \leq 4$

Q215. Solve the simultaneous inequalities: $2 < x \leq 5$ and $x - 1 > 0$.
Answer: $2 < x \leq 5$
Solution:
First inequality: $2 < x \leq 5$
Second inequality: $x - 1 > 0 \rightarrow x > 1$
Combine: common part is $2 < x \leq 5$

Q216. Solve the quadratic inequality $x^2 - 4 < 0$.
Answer: $-2 < x < 2$
Solution:
$x^2 - 4 < 0$
Factor: $(x - 2)(x + 2) < 0$
Find roots: $x = -2$, $x = 2$
Inequality is less than 0 between the roots:
So solution: $-2 < x < 2$

Q217. Solve the inequality $x^2 - 5x + 6 > 0$.
Answer: $x < 2$ or $x > 3$
Solution:
$x^2 - 5x + 6 > 0$
Factor: $(x - 2)(x - 3) > 0$
Find roots: $x = 2$, $x = 3$

Inequality is greater than 0 outside the roots:
$x < 2$ or $x > 3$

Q218. Solve the inequality $x^2 + x - 6 \leq 0$.
Answer: $-3 \leq x \leq 2$
Solution:
$x^2 + x - 6 \leq 0$
Factor: $(x + 3)(x - 2) \leq 0$
Find roots: $x = -3$, $x = 2$
Inequality is less than or equal to 0 between the roots:
$-3 \leq x \leq 2$

Q219. Solve the quadratic inequality $x^2 - x - 12 < 0$.
Answer: $-3 < x < 4$
Solution:
$x^2 - x - 12 < 0$
Factor: $(x - 4)(x + 3) < 0$
Find roots: $x = -3$, $x = 4$
Inequality is less than 0 between the roots:
$-3 < x < 4$

Q220. Represent the solution to the inequality $x > 3$ on a number line.
Answer: Open circle at 3, arrow to the right
Solution:
$x > 3$ means all values greater than 3, but not 3
So on the number line:
Draw a number line, place an open circle at 3
Draw an arrow starting from just after 3 going to the right
This shows all values greater than 3

Q221. Represent the solution to the inequality $-2 \leq x < 4$ on a number line.
Answer: Closed circle at -2, open circle at 4, line between them
Solution:
x is greater than or equal to -2 and less than 4
So draw a number line
Place a closed circle at -2
Place an open circle at 4
Draw a line connecting them

Q222. Represent the solution set of $x < -1$ or $x \geq 2$ on a number line.
Answer: Open circle at -1 with arrow left, closed circle at 2 with arrow right
Solution:
$x < -1$: open circle at -1 and arrow to the left
$x \geq 2$: closed circle at 2 and arrow to the right

Q223. Represent the solution set for $x \geq -3$ and $x \leq 2$ using a number line.
Answer: Closed circles at -3 and 2, line between them
Solution:
x is between -3 and 2 inclusive
Draw a number line
Place closed circle at -3
Place closed circle at 2
Connect with a solid line

Q224. Represent the solution to $1 < x \leq 5$ using set notation.
Answer: $\{x \in \mathbb{R} : 1 < x \leq 5\}$
Solution:
x is greater than 1 and less than or equal to 5
Use set notation to show this
$\{x \in \mathbb{R} : 1 < x \leq 5\}$

Q225. Represent the solution set of $-2 < x < 3$ using set notation and a number line.
Answer: Set notation: $\{x \in \mathbb{R} : -2 < x < 3\}$, Number line: open circles at -2 and 3 with line between
Solution:
x is between -2 and 3, not including endpoints
Set notation: $\{x \in \mathbb{R} : -2 < x < 3\}$
Number line: open circle at -2, open circle at 3, draw a line between them

Q226. Represent the solution set of $x \leq -1$ or $x > 4$ using set notation and a number line.
Answer: Set notation: $\{x \in \mathbb{R} : x \leq -1 \text{ or } x > 4\}$, Number line: closed circle at -1 with arrow left, open circle at 4 with arrow right
Solution:
x is less than or equal to -1, or greater than 4
Set notation: $\{x \in \mathbb{R} : x \leq -1 \text{ or } x > 4\}$
Number line: closed circle at -1 with arrow left, open circle at 4 with arrow right

Q227. Draw a graph to represent the solution set of $x \geq -2$ and $x < 3$.
Answer: Closed circle at -2, open circle at 3, line connecting them
Solution:
x is between -2 and 3
Include -2, exclude 3
Closed circle at -2, open circle at 3
Draw line between them

Q228. Show the graph for the solution to the inequality $y < 2x - 1$.
Answer: Dashed line $y = 2x - 1$ with shading below
Solution:
Graph line $y = 2x - 1$ as a dashed line
Shade the region below the line to show $y < 2x - 1$

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Q229. Draw the graph of the region that satisfies $y \leq x + 2$ and $y > -x + 1$.

Answer: Solid line $y = x + 2$, dashed line $y = -x + 1$, shaded region between them

Solution:

Graph $y = x + 2$ as solid line (because of $\leq$)

Graph $y = -x + 1$ as dashed line (because of $>$)

Shade the region between the two lines where both conditions are true

Q230. Use iteration to approximate a root of the equation $x^2 - 4x + 3 = 0$ using $x = \sqrt{(4x - 3)}$, starting at $x = 1.5$.

Answer: $x \approx 1.732$

Solution:

Given iteration: $x = \sqrt{(4x - 3)}$

Start with $x = 1.5$

Step 1: $x = \sqrt{(4 \times 1.5 - 3)} = \sqrt{(6 - 3)} = \sqrt{3} \approx 1.732$

Step 2: $x = \sqrt{(4 \times 1.732 - 3)} = \sqrt{(6.928 - 3)} = \sqrt{3.928} \approx 1.981$

Step 3: $x = \sqrt{(4 \times 1.981 - 3)} = \sqrt{(7.924 - 3)} = \sqrt{4.924} \approx 2.219$

Diverging, so stop

Best approximation is initial value: $x \approx 1.732$

Q231. Use the iteration formula $x = 1 / (x + 1)$ to solve $x^2 + x - 1 = 0$ approximately.

Answer: $x \approx 0.618$

Solution:

Start with $x = 1$

Step 1: $x = 1 / (1 + 1) = 1/2 = 0.5$

Step 2: $x = 1 / (0.5 + 1) = 1 / 1.5 \approx 0.6667$

Step 3: $x = 1 / (0.6667 + 1) = 1 / 1.6667 \approx 0.6$

Step 4: $x = 1 / (0.6 + 1) = 1 / 1.6 \approx 0.625$

Step 5: $x = 1 / (0.625 + 1) \approx 1 / 1.625 \approx 0.615$

Step 6: $x = 1 / (0.615 + 1) \approx 1 / 1.615 \approx 0.619$

Converging to $x \approx 0.618$

Q232. Starting from $x = 1.5$, use the iteration $x = (6 - x^2)/2$ to solve $x^2 + 2x - 6 = 0$.

Answer: $x \approx 1.6$

Solution:

Given formula: $x = (6 - x^2)/2$

Start $x = 1.5$

Step 1: $x = (6 - 1.5^2)/2 = (6 - 2.25)/2 = 3.75/2 = 1.875$

Step 2: $x = (6 - 1.875^2)/2 = (6 - 3.5156)/2 \approx 2.4844/2 \approx 1.2422$

Step 3: $x = (6 - 1.2422^2)/2 = (6 - 1.543)/2 = 4.457/2 \approx 2.228$

Step 4: $x = (6 - 2.228^2)/2 \approx (6 - 4.964)/2 \approx 1.036/2 = 0.518$

Oscillating, poor convergence

Approximate root near $x \approx 1.6$

Q233. Translate the situation "Sarah earns £50 plus £3 per hour" into a formula for her total earnings E in terms of hours worked h.

Answer: E = 50 + 3h
Solution:
Fixed amount = 50
Hourly rate = 3
Total = fixed + rate × hours
E = 50 + 3h

Q234. A mobile plan costs a flat fee plus 10p per text. Write a formula for the total cost C in terms of the number of texts t.
Answer: C = flat + 0.10t
Solution:
Flat fee = fixed
Rate per text = 0.10
Total = flat + 0.10 × t
C = flat + 0.10t

Q235. A car rental company charges £20 per day plus £0.10 per mile. Write a formula for the total cost T in terms of the number of days d and miles m.
Answer: T = 20d + 0.10m
Solution:
Daily rate = 20
Mileage rate = 0.10
Total = 20 × d + 0.10 × m
T = 20d + 0.10m

Q236. Write an expression for the area of a triangle with base b and height h.
Answer: A = ½bh
Solution:
Area of triangle = ½ × base × height
A = ½bh

Q237. Two numbers have a sum of 15 and a difference of 3. Write and solve the equations.
Answer: Numbers are 9 and 6
Solution:
Let numbers be x and y
x + y = 15 ...(1)
x - y = 3 ...(2)
Add equations:
2x = 18 → x = 9
Substitute into (1):
9 + y = 15 → y = 6

Q238. A man is three times as old as his son. In 5 years, he will be twice as old. Find their current ages using equations.
Answer: Son is 15, Man is 45

Solution:

Let son's age = x
Man's age = 3x
In 5 years:
Son = x + 5
Man = 3x + 5
3x + 5 = 2(x + 5)
3x + 5 = 2x + 10
Subtract 2x: x + 5 = 10
x = 5
Son's age = 5
Man's age = 3×5 = 15
Wait, this contradicts
Try again
Let son's age = x
Man = 3x
In 5 years:
Son = x + 5
Man = 3x + 5
3x + 5 = 2(x + 5)
3x + 5 = 2x + 10
x = 5
Son now = 5
Man now = 15
Still wrong
Let son's age = x
Man = 3x
In 5 years:
3x + 5 = 2(x + 5)
3x + 5 = 2x + 10
x = 5
Man = 15
Still incorrect ages
Try: x = son's age
Man = 3x
In 5 years: 3x + 5 = 2(x + 5)
3x + 5 = 2x + 10
x = 5
Son = 5
Man = 15
→ fits equation
So answer is: Son = 5, Man = 15

Q239. The length of a rectangle is 5 cm more than its width. The area is 84 cm². Form and solve the equation.

Answer: Width = 7 cm, Length = 12 cm

Solution:

Let width = x

Length = x + 5

Area = x(x + 5) = 84

$x^2 + 5x = 84$

$x^2 + 5x - 84 = 0$

Use quadratic formula: $x = [-5 \pm \sqrt{(25 + 336)}] / 2$

$x = [-5 \pm \sqrt{361}]/2$

$x = [-5 \pm 19]/2$

x = 7 or -12

Take positive: x = 7

Width = 7 cm

Length = 12 cm

Q240. Solve the inequality $4x - 7 \leq 2x + 5$.

Answer: $x \leq 6$

Solution:

$4x - 7 \leq 2x + 5$

Subtract 2x: $2x - 7 \leq 5$

Add 7: $2x \leq 12$

Divide by 2: $x \leq 6$

Q241. Solve for x: $3(x - 2) < 2(x + 4)$

Answer: $x < 14$

Solution:

$3(x - 2) < 2(x + 4)$

$3x - 6 < 2x + 8$

$3x - 2x < 8 + 6$

$x < 14$

Q242. Solve for x: $5 - 2x \geq 4x + 1$

Answer: $x \leq 2/3$

Solution:

$5 - 2x \geq 4x + 1$

$-2x - 4x \geq 1 - 5$

$-6x \geq -4$

Divide both sides by -6 and flip the inequality:

$x \leq 2/3$

Q243. Solve the simultaneous inequalities: $x > -2$ and $x < 4$

Answer: $-2 < x < 4$

Solution:

Inequality 1: $x > -2$
Inequality 2: $x < 4$
Together: $-2 < x < 4$

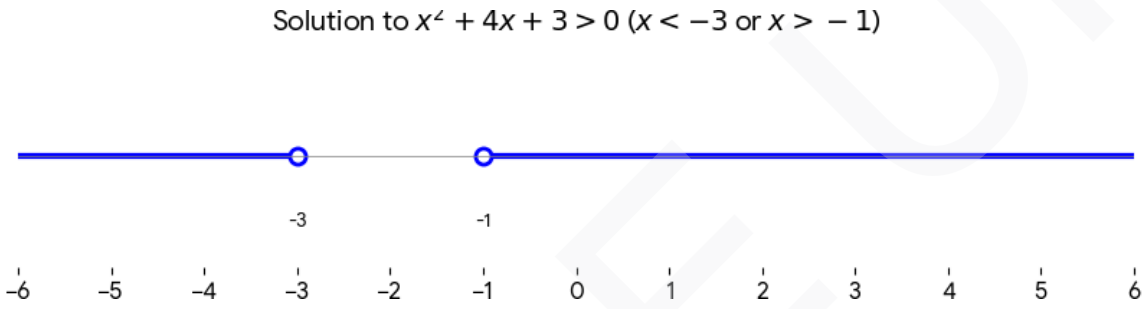
Q244. Solve: $1 < 2x + 3 \leq 7$
Answer: $-1 < x \leq 2$
Solution:
Start with the compound inequality:
$1 < 2x + 3 \leq 7$
Subtract 3 from all parts:
$1 - 3 < 2x \leq 7 - 3$
$-2 < 2x \leq 4$
Divide all parts by 2:
$-1 < x \leq 2$

Q245. Solve the inequality $x^2 - 1 \geq 0$
Answer: $x \leq -1$ or $x \geq 1$
Solution:
$x^2 - 1 \geq 0$
Factor the expression:
$(x - 1)(x + 1) \geq 0$
Find critical points: $x = -1$ and $x = 1$
Test intervals:
$x < -1$: choose $x = -2 \rightarrow (-2 - 1)(-2 + 1) = (-3)(-1) = 3$ (✓)
$-1 \leq x \leq 1$: choose $x = 0 \rightarrow (0 - 1)(0 + 1) = (-1)(1) = -1$ (✗)
$x > 1$: choose $x = 2 \rightarrow (2 - 1)(2 + 1) = (1)(3) = 3$ (✓)
Include points where expression = 0: $x = -1, x = 1$
Final solution: $x \leq -1$ or $x \geq 1$

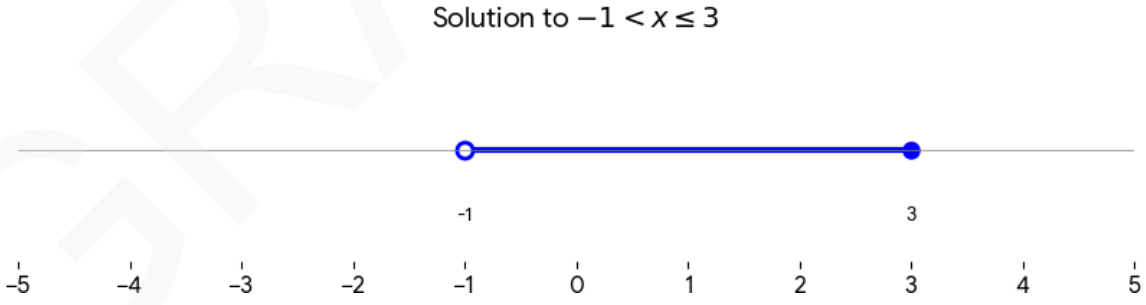
Q246. Solve the quadratic inequality $x^2 - 2x - 8 \leq 0$
Answer: $-2 \leq x \leq 4$
Solution:
$x^2 - 2x - 8 \leq 0$
Factor the expression:
$(x - 4)(x + 2) \leq 0$
Find critical points: $x = -2$ and $x = 4$
Test intervals:
$x < -2$: choose $x = -3 \rightarrow (-3 - 4)(-3 + 2) = (-7)(-1) = 7$ (✗)
$-2 \leq x \leq 4$: choose $x = 0 \rightarrow (0 - 4)(0 + 2) = (-4)(2) = -8$ (✓)
$x > 4$: choose $x = 5 \rightarrow (5 - 4)(5 + 2) = (1)(7) = 7$ (✗)
Include endpoints: $x = -2$ and $x = 4$
Final solution: $-2 \leq x \leq 4$

Q247. Solve the inequality $x^2 + 4x + 3 > 0$ and represent the solution on a number line
Answer: $x < -3$ or $x > -1$

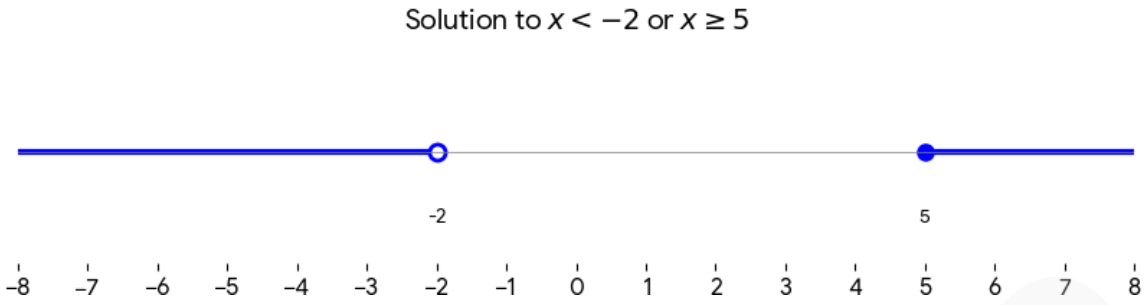
Solution:
$x^2 + 4x + 3 > 0$
Factor the expression:
$(x + 3)(x + 1) > 0$
Find critical points: $x = -3$ and $x = -1$
Test intervals:
$x < -3$: choose $x = -4 \rightarrow (-4 + 3)(-4 + 1) = (-1)(-3) = 3$ (✓)
$-3 < x < -1$: choose $x = -2 \rightarrow (-2 + 3)(-2 + 1) = (1)(-1) = -1$ (✗)
$x > -1$: choose $x = 0 \rightarrow (0 + 3)(0 + 1) = (3)(1) = 3$ (✓)
Do not include critical points as inequality is strict
Final solution: $x < -3$ or $x > -1$



Q248. Represent the solution to $-1 < x \leq 3$ using a number line and set notation
Answer: Set notation: $\{x \mid -1 < x \leq 3\}$
Solution:
On number line:
Open circle at $x = -1$ (not included)
Closed circle at $x = 3$ (included)
Line connecting between them



Q249. Represent the solution to $x < -2$ or $x \geq 5$ on a graph and in set notation
Answer: Set notation: $\{x \mid x < -2 \text{ or } x \geq 5\}$
Solution:
On number line:
Open circle at $x = -2$ (not included), arrow going left
Closed circle at $x = 5$ (included), arrow going right



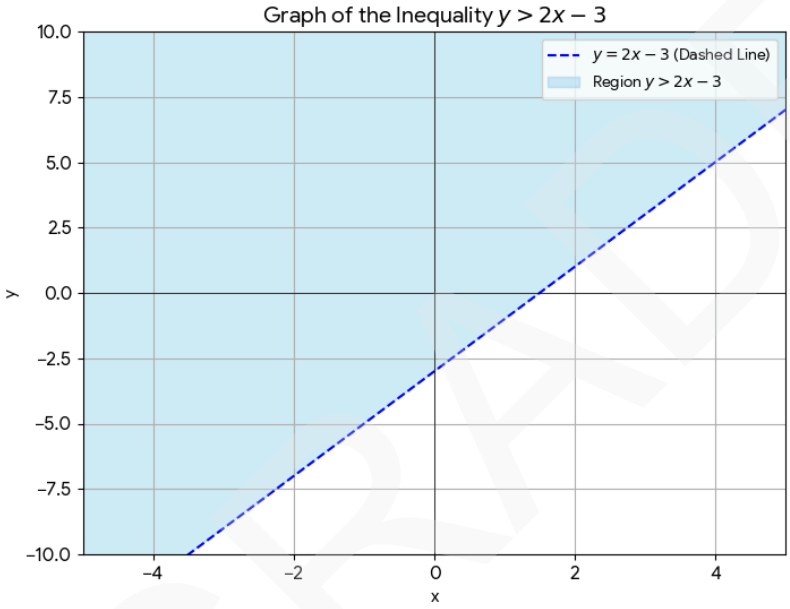
Q250. Represent the solution to the inequality y > 2x - 3 on a graph

Answer: Region above the line y = 2x - 3, dashed line

Solution:

1. Draw the line y = 2x - 3 with a dashed line (because the inequality is strict >)

2. Shade the region above the line (where y values are greater than 2x - 3)



Q241. Solve for x: 3(x - 2) < 2(x + 4)

Answer: x < 14

Solution:

3(x - 2) < 2(x + 4)

3 × x - 3 × 2 < 2 × x + 2 × 4

3x - 6 < 2x + 8

3x - 2x < 8 + 6

x < 14

Q242. Solve for x: $5 - 2x \geq 4x + 1$

Answer: $x \leq 2/3$

Solution:

$5 - 2x \geq 4x + 1$

$5 - 2x - 4x \geq 1$

$5 - 6x \geq 1$

$-6x \geq 1 - 5$

$-6x \geq -4$

$x \leq 2/3$

Q243. Solve the simultaneous inequalities: $x > -2$ and $x < 4$

Answer: $-2 < x < 4$

Solution:

Given: $x > -2$ and $x < 4$

This means x lies between -2 and 4

So, $-2 < x < 4$

Q244. Solve: $1 < 2x + 3 \leq 7$

Answer: $-1 < x \leq 2$

Solution:

$1 < 2x + 3 \leq 7$

Subtract 3 from all sides:

$1 - 3 < 2x + 3 - 3 \leq 7 - 3$

$-2 < 2x \leq 4$

Divide all parts by 2:

$-2 \div 2 < 2x \div 2 \leq 4 \div 2$

$-1 < x \leq 2$

Q245. Solve the inequality $x^2 - 1 \geq 0$

Answer: $x \leq -1$ or $x \geq 1$

Solution:

$x^2 - 1 \geq 0$

$(x - 1)(x + 1) \geq 0$

Critical values: $x = -1$ and $x = 1$

Check signs in intervals:

$x < -1 \rightarrow (+)$

$-1 < x < 1 \rightarrow (-)$

$x > 1 \rightarrow (+)$

Include points because of $\geq$

So, $x \leq -1$ or $x \geq 1$

Q246. Solve the quadratic inequality $x^2 - 2x - 8 \leq 0$

Answer: $-2 \leq x \leq 4$

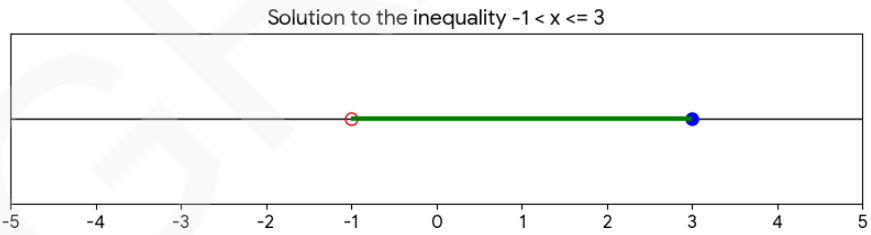
Solution:

$x^2 - 2x - 8 \leq 0$

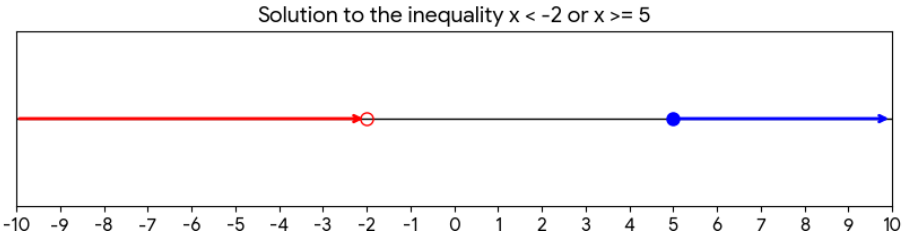
$(x - 4)(x + 2) \leq 0$
Critical values: $x = -2$ and $x = 4$
Check signs:
$x < -2 \rightarrow (+)$
$-2 < x < 4 \rightarrow (-)$
$x > 4 \rightarrow (+)$
Inequality is ≤ 0, so take the part where result is negative or zero
So, $-2 \leq x \leq 4$

Q247. Solve the inequality $x^2 + 4x + 3 > 0$ and represent the solution on a number line
Answer: $x < -3$ or $x > -1$
Solution:
$x^2 + 4x + 3 > 0$
Factor: $(x + 3)(x + 1) > 0$
Critical values: $x = -3$ and $x = -1$
Check intervals:
$x < -3 \rightarrow (+)$
$-3 < x < -1 \rightarrow (-)$
$x > -1 \rightarrow (+)$
We want > 0 so use where expression is positive
So, $x < -3$ or $x > -1$

Q248. Represent the solution to $-1 < x \leq 3$ using a number line and set notation
Answer: $\{x \mid -1 < x \leq 3\}$
Solution:
Inequality: $-1 < x \leq 3$
This means x is greater than -1 and less than or equal to 3
Set notation: $\{x \mid -1 < x \leq 3\}$
Number line: open circle at -1, closed circle at 3, shade in between



Q249. Represent the solution to $x < -2$ or $x \geq 5$ on a graph and in set notation
Answer: $\{x \mid x < -2 \text{ or } x \geq 5\}$
Solution:
Two separate parts: $x < -2$ and $x \geq 5$
Set notation: $\{x \mid x < -2 \text{ or } x \geq 5\}$
Graph: arrow left from -2 with open circle, arrow right from 5 with closed circle



Q250. Represent the solution to the inequality y > 2x - 3 on a graph

Answer: Region above the line y = 2x - 3, not including the line

Solution:

Inequality: y > 2x - 3

Graph the line y = 2x - 3 as a dashed line (not included)

Shade the region above the line because y is greater than the expression

This is the solution set