

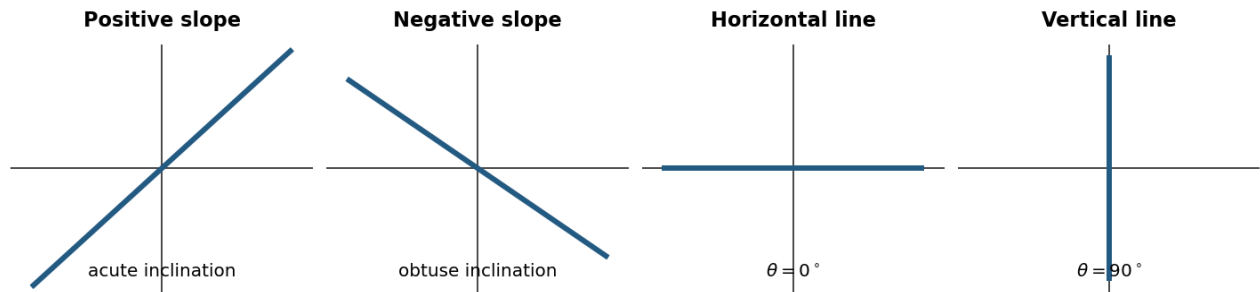
Calculus 1

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Lines and Angles

Angle of inclination: the angle measured counterclockwise from the positive x-axis to a line. $0^\circ \leq \theta < 180^\circ$

$$m =$$



A line is not acute or obtuse. Its angle of inclination can be acute or obtuse.

When an equation is given, first find its intercept form. Then identify the intercepts, slope, and angle of inclination.

$$2x - y - 4 = 0$$

→

$$2x - y = 4$$

→

$$x/2 - y/4 = 1$$

$$x\text{-int.} = 2, y\text{-int.} = -4$$

→

$$y = 2x - 4$$

→

$$m = 2$$

→

$$\theta = \tan^{-1}(2) \approx 63.4^\circ$$

Intercept form: $x/a + y/b = 1$, where a is the x -intercept and b is the y -intercept.

For each equation, write the intercept form. Then find the x -intercept, y -intercept, slope, and angle of inclination.

Equation	Intercept form	x -int.	y -int.	m	θ
1. $x + y = 4$					
2. $2x - y = 6$					
3. $x + 2y = 8$					
4. $3x - y = 9$					
5. $2x + 3y = 6$					

Using $m = \tan \theta$

For Questions 6-9, each listed slope is a tangent value. Use $m = \tan \theta$ and choose $0^\circ \leq \theta < 180^\circ$.

6. Find the angle of inclination of a line with each slope.

a. $m = 0$

b. $m = 3$

c. $m = -1$

7. Find the slope of a line with each angle of inclination.

a. $\theta = 30^\circ$

b. $\theta = 135^\circ$

c. $\theta = 90^\circ$

8. Find the slope and the angle of inclination of the line through the points (1, 2) and (5, 6).

9. For each line: (1) identify the slope, then (2) find the angle of inclination. Round to the nearest tenth.

a. $y = 2x - 1$

b. $y = -(3/4)x + 5$

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Angle Between Two Lines

Start with the angles of inclination. If θ_1 and θ_2 are the angles of inclination of two lines, the angle between them is $\theta_2 - \theta_1$.

$$\tan(\theta_2 - \theta_1) =$$

Since $m_1 = \tan \theta_1$ and $m_2 = \tan \theta_2$,

$$\tan \theta =$$

Find the acute angle between the lines $2x - y - 4 = 0$ and $3x + 4y - 12 = 0$.

10. First find m_1 and m_2 . Then find the acute angle between the lines.

$$y = 2x - 1$$

$$y = -(1/3)x + 4$$

11. First find m_1 and m_2 . Then find the acute angle between the lines.

$$x - 2y + 3 = 0$$

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

12. Find the acute angle between the lines. Draw a quick sketch and use angles of inclination.

$$x = 3$$

$$y = -2x + 5$$

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Distance Between a Point and a Line

Distance means the length of the perpendicular segment from the point to the line.

$$d = |Ax_1 + By_1 + C| / \sqrt{A^2 + B^2}$$

Find the distance from $(2, -1)$ to the line $3x - 4y + 6 = 0$.

13. Find the distance from $(4, -1)$ to the line $2x + y - 4 = 0$.

14. Find the distance from $(-2, 3)$ to the line $x - 2y + 5 = 0$.

15. Let $P(x, y)$ be a point, and let the line $y = -p$ be a directrix. Use the point-to-line distance formula to show that the distance from P to the directrix is $|y + p|$.

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Parabolas

Definition: A parabola is the set of all points that are the same distance from a focus and a directrix.

For a parabola with focus $(0, p)$ and directrix $y = -p$:

distance to focus =

distance to directrix =

When the vertex moves from $(0, 0)$ to (h, k) :

$$(x - h)^2 = 4p(y - k) \quad (y - k)^2 = 4p(x - h)$$

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Graphing Parabolas

Vertical axis $(x - h)^2 = 4p(y - k)$ Focus: $(h, k + p)$ Directrix: $y = k - p$ Axis: $x = h$	Horizontal axis $(y - k)^2 = 4p(x - h)$ Focus: $(h + p, k)$ Directrix: $x = h - p$ Axis: $y = k$
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The sign of p tells the opening direction.

Worked Example

For $(x - 2)^2 = -12(y + 1)$, identify the vertex, focus, directrix, axis of symmetry, and opening direction. Then graph the parabola.



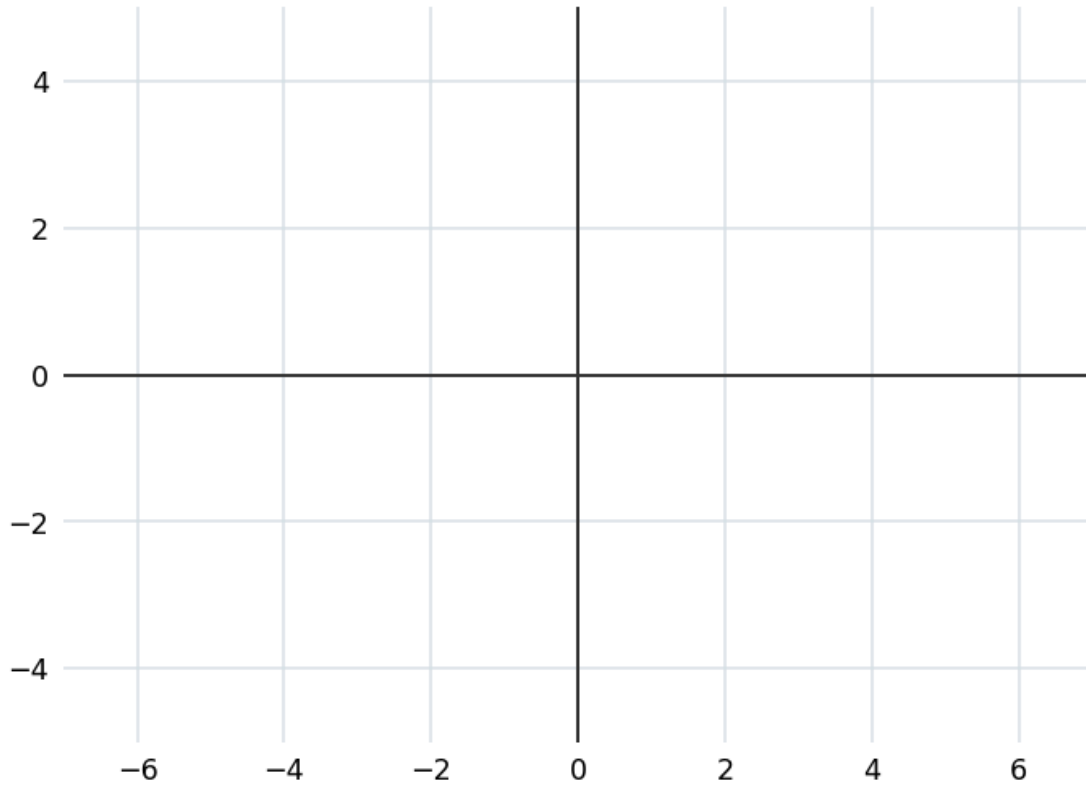
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Graphing Parabolas

16. For the parabola below, identify the vertex, focus, directrix, axis of symmetry, and opening direction. Then graph it.

$$(x + 1)^2 = 8(y - 3)$$

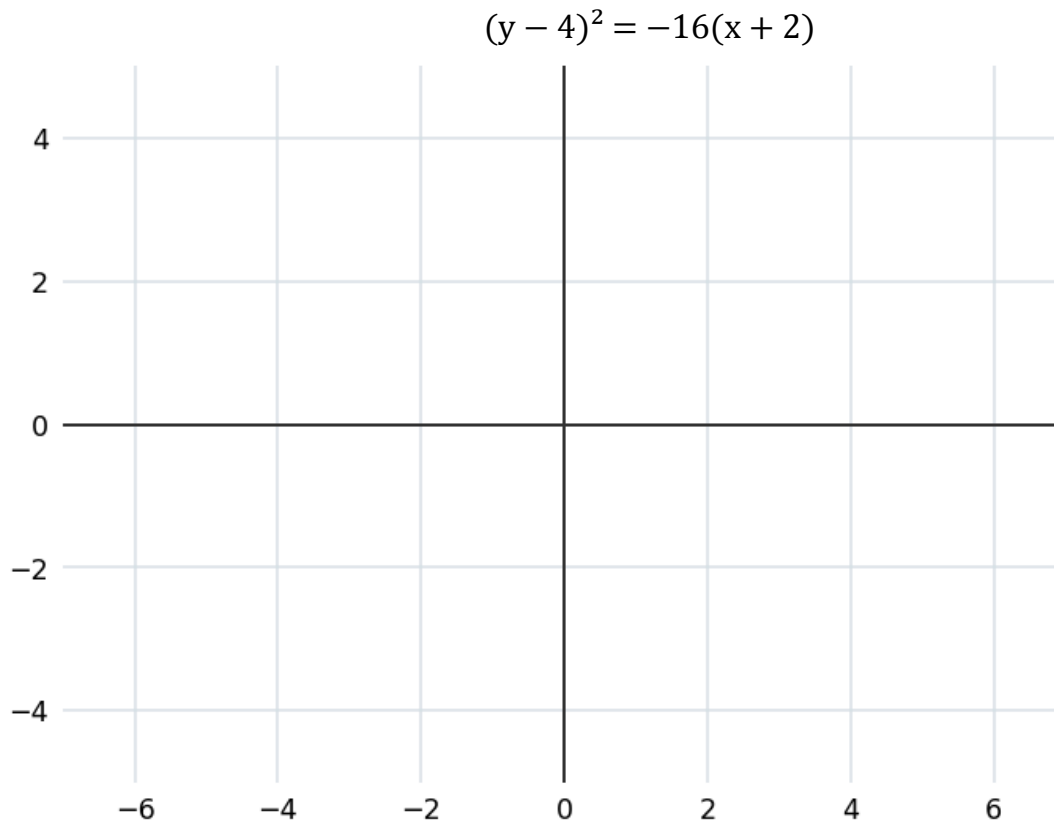


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Writing and Applying Parabola Equations

17. For the parabola below, identify the vertex, focus, directrix, axis of symmetry, and opening direction. Then graph it.



18. Write the equation of the parabola with vertex $(3, -2)$ and directrix $y = 2$.

19. Write the equation of the parabola with vertex $(-2, 1)$ and focus $(1, 1)$.

20. The focus is $(4, -1)$, and the directrix is $x = 0$. Find the vertex first. Then write the equation of the parabola.