

Intercepts and Peaks

Draw linear and quadratic graphs and label their features.

HIGH SCHOOL · HSF-IF.C.7a

CCSS.Math.Content.HSF-IF.C.7a "Graph linear and quadratic functions and show intercepts, maxima, and minima."

NAME _____

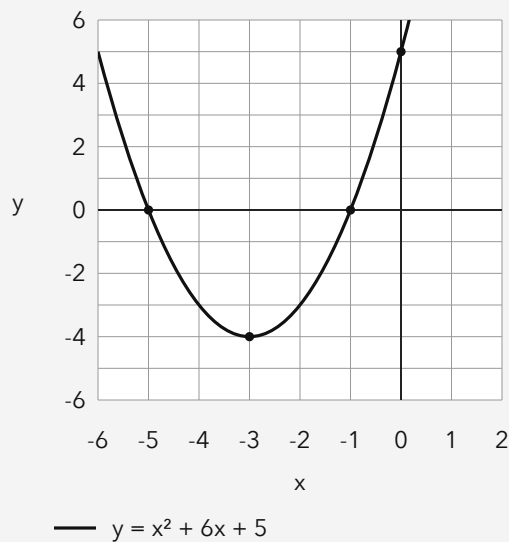
DATE _____

FROM KEY POINTS TO A GRAPH

Set $y = 0$ to find x -intercepts and $x = 0$ for the y -intercept. For $y = ax^2 + bx + c$, the vertex has $x = -b/(2a)$. It is a minimum when $a > 0$ and a maximum when $a < 0$. Plot these points and symmetric points, then draw the entire visible line or smooth parabola. A nonconstant unrestricted line has no maximum or minimum.

WORKED EXAMPLE

Graph $y = x^2 + 6x + 5$. Label its intercepts and minimum.

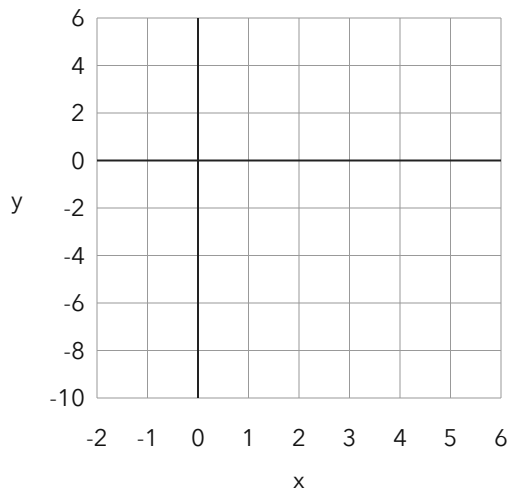


1. Factor: $(x + 5)(x + 1) = 0$ gives x -intercepts $(-5, 0)$ and $(-1, 0)$.
2. At $x = 0$, $y = 5$. The vertex has $x = -6/2 = -3$ and $y = -4$.
3. Plot the points and draw a smooth upward-opening parabola.

Answer: x -intercepts $(-5, 0)$, $(-1, 0)$; y -intercept $(0, 5)$; minimum $(-3, -4)$.

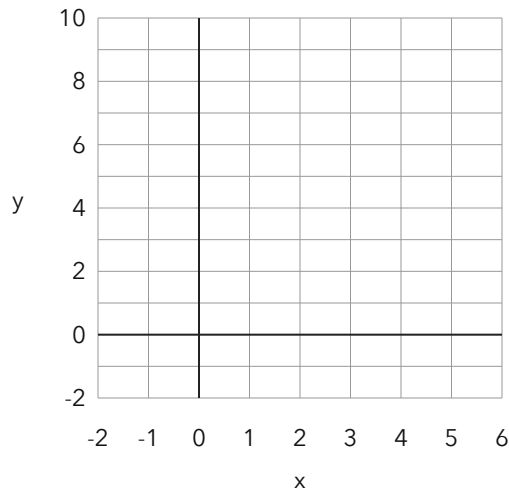
PRACTICE 4 problems

- 1** Graph $y = 2x - 8$. Label intercepts. Does this line have a maximum or minimum?



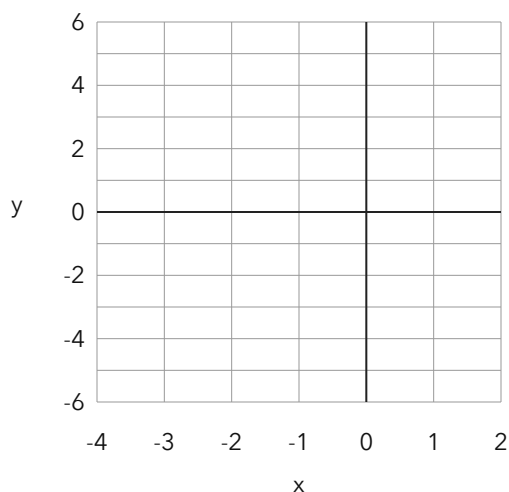
ANSWER _____

- 2** Graph $y = -x^2 + 4x + 5$. Label all intercepts and the maximum.



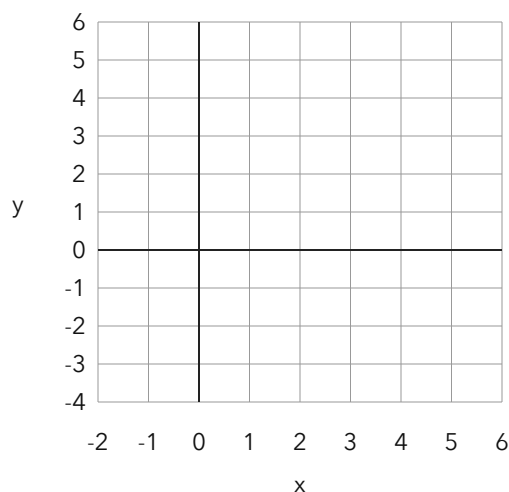
ANSWER _____

- 3** Graph $y = x^2 + 2x - 3$. Label all intercepts and the minimum.



ANSWER _____

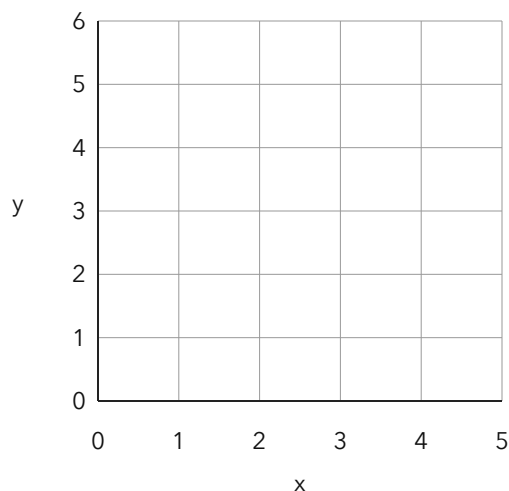
- 4** Graph $y = -x + 3$. Label intercepts. Explain why $(0, 3)$ is not a maximum.



ANSWER _____

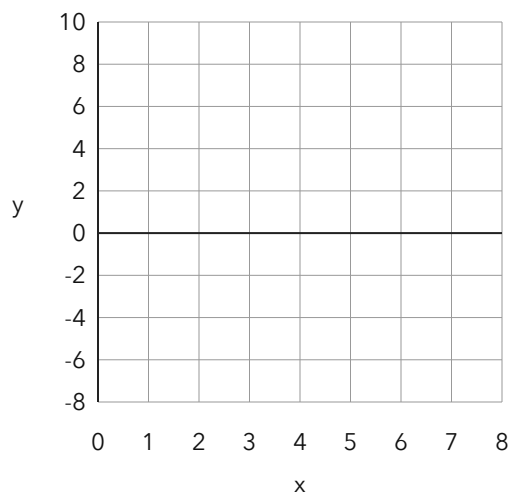
APPLY IT Show your work**1**

In a video game, a ball's height is $h = -t^2 + 4t$, where t is seconds and h is game units. Graph only $0 \leq t \leq 4$ (horizontal: t ; vertical: h). Label ground contacts and the maximum. Explain what the maximum means.

**REASONING AND ANSWER**

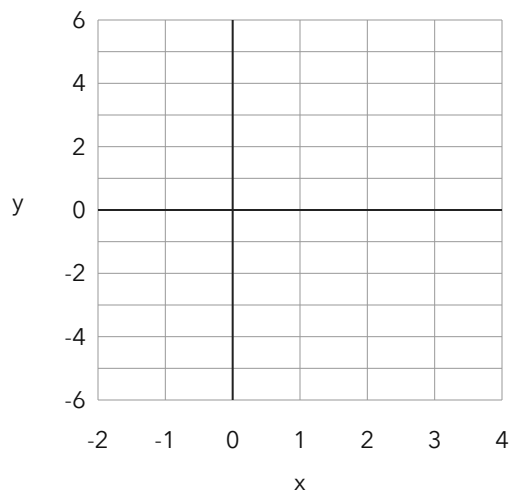
2

A club's hypothetical profit model is $P = -x^2 + 8x - 7$ for ticket prices $0 \leq x \leq 8$ dollars. P is in hundreds of dollars. Graph it (horizontal: x ; vertical: P). Label both break-even prices, the y -intercept, and the maximum. Interpret the maximum in dollars.

**REASONING AND ANSWER**

CHALLENGE One step up

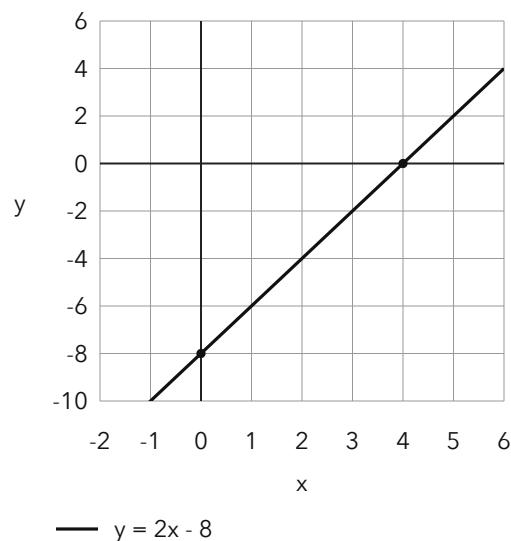
A quadratic has x-intercepts $(-1, 0)$ and $(3, 0)$ and passes through $(0, -3)$. Find its equation and graph it. Label the y-intercept and vertex, and identify the vertex as a maximum or minimum.



WORK SPACE AND ANSWER

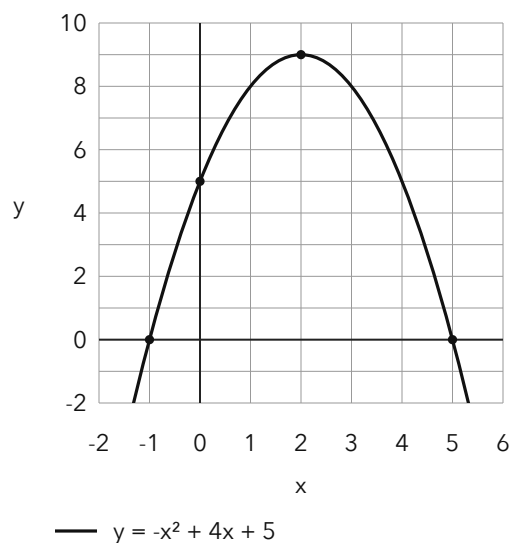
PRACTICE 1

Intercepts $(4, 0)$ and $(0, -8)$. Neither: the line continues upward and downward without bound.



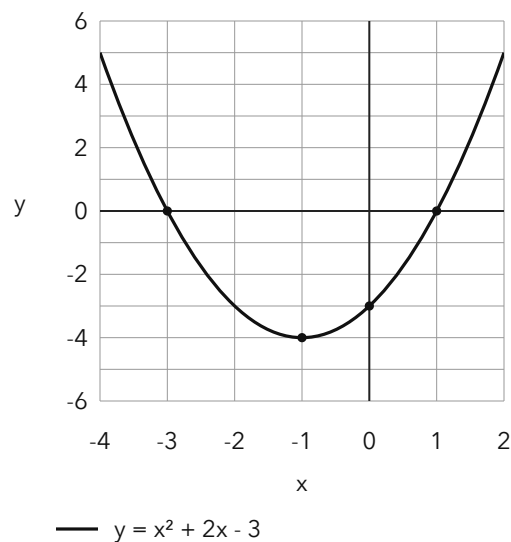
PRACTICE 2

x-intercepts $(-1, 0)$ and $(5, 0)$; y-intercept $(0, 5)$; maximum $(2, 9)$.



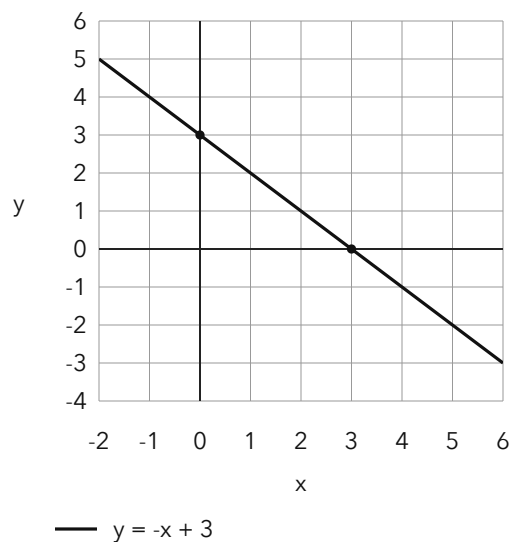
PRACTICE 3

x-intercepts $(-3, 0)$ and $(1, 0)$; y-intercept $(0, -3)$; minimum $(-1, -4)$.



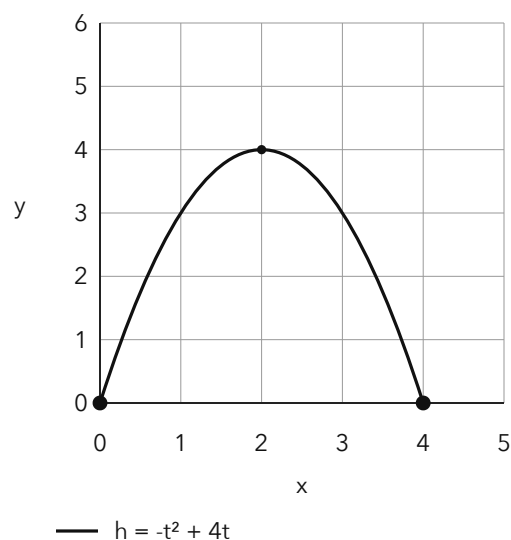
PRACTICE 4

Intercepts $(3, 0)$ and $(0, 3)$. For negative x , $y > 3$; this unrestricted line has no maximum.



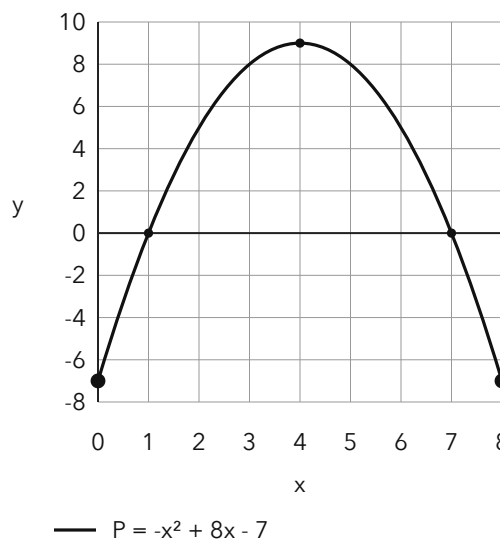
APPLY IT 1

Ground contacts (0, 0) and (4, 0); maximum (2, 4): after 2 seconds, the ball reaches 4 game units. $h = -t(t - 4)$ gives $t = 0$ and 4. The vertex occurs at $t = -4/(-2) = 2$. The model is restricted to this one jump.



APPLY IT 2

Break-even prices \$1 and \$7; y-intercept (0, -7); maximum (4, 9), meaning \$900 profit at a \$4 price. $P = -(x - 1)(x - 7)$. The vertex lies halfway between 1 and 7 at $x = 4$; $P = 9$ hundreds. This hypothetical model is used only for prices from \$0 to \$8.



CHALLENGE

$y = (x + 1)(x - 3) = x^2 - 2x - 3$. y-intercept (0, -3); vertex (1, -4), a minimum since the leading coefficient is positive.

Require actual graphs with labeled features, not just numerical answers. Accept equivalent factored equations and legible approximate sketches passing through the exact key points. Unrestricted lines and parabolas continue beyond the grid. The two applied models are restricted to the stated domains; their endpoint dots belong to the models. A line crossing an axis has an intercept, not a turning point.

