

Show that each function is a quadratic function by writing it in standard form. Identify a, b & c.

1. $f(x) = (x - 3)(x - 5)$

$$f(x) = x^2 - 8x + 15$$

$a = 1 \quad b = -8 \quad c = 15$

3. $k(x) = -3(x - 11)(x + 1)$

$$k(x) = -3x^2 + 30x + 33$$

$a = -3 \quad b = 30 \quad c = 33$

5. $d(x) = (x - 3)^2 - 4$

$$d(x) = x^2 - 6x + 5$$

$a = 1 \quad b = -6 \quad c = 5$

2. $g(x) = (7 - x)(9 - x)$

$$g(x) = x^2 - 16x + 63$$

$a = 1 \quad b = -16 \quad c = 63$

4. $h(x) = (2x + 5)(3x - 1)$

$$h(x) = 6x^2 + 13x - 5$$

$a = 6 \quad b = 13 \quad c = -5$

State whether each function is quadratic. Use a graph to verify. Provide an explanation about why each IS/IS NOT quadratic based on the equation and based on the graph.

6. $f(x) = -4x + x^2$ Yes - Quad

- graph = parabola (opens up)
- eq in SF = $f(x) = x^2 - 4x + 0$

8. $h(x) = \frac{2x^2 + x}{x^2 - 1}$ No

graph = not parabola

eq: has x's in denom

10. $b(x) = x^2 - 2x(x + 1)$ Yes

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

graph = parabola (opens down)

eq = QUAD in SF = $-x^2 - 2x$

7. $k(x) = \frac{1}{x}$ No

graph ↘ ↗

eq: no x^2 / x 's in denom

9. $g(x) = 16 - 3x$ No

graph & eq = linear

11. $m(x) = 3x - x(x + 9)$ Yes

$$3x - x^2 - 9x$$

$$m(x) = -x^2 - 6x \quad \leftarrow \text{eq: in SF}$$

graph = parabola (opens down)

WITHOUT A CALCULATOR, state whether the parabola opens up or down and whether the y-coordinate of the vertex is the minimum value or the maximum value of the function. Then use your calculator to find the max/ min value.

12. $f(x) = 5x^2 - 3x$ MIN

$$\text{AOS } x = \frac{-b}{2a} = \frac{3}{10} = 0.3$$

$$(0.3, -0.45)$$

$$(-\frac{9}{20}, -\frac{1}{2})$$

13. $g(x) = 4x^2 + 7x - 2$ MIN

$$\text{AOS } x = -\frac{b}{2a} = -\frac{7}{2(4)} = -\frac{7}{8}$$

$$(-\frac{7}{8}, -5\frac{1}{16})$$

14. $h(x) = (5 - x)(2 - 3x)$ MIN

$$\text{AOS: } x = \frac{5+2}{3+1} = \frac{7}{4} = 1.75$$

$$(\frac{7}{4}, -\frac{169}{12})$$

$$(2\frac{1}{2}, -14\frac{1}{12})$$

15. $q(x) = (4 - x)(2 + 7x)$ MAX

$$x = -\frac{b}{2a} = -\frac{2+7}{2(-1)} = -\frac{9}{2} = -4.5$$

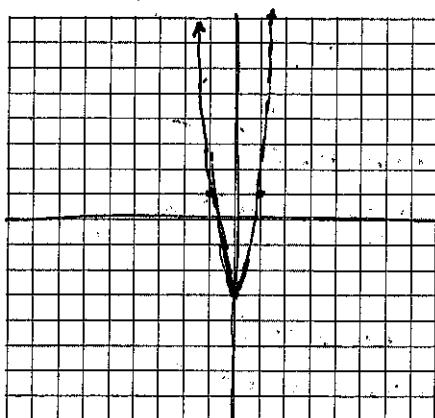
$$(1.86, 36.1)$$

$$p(x) = -x^2 - 3\frac{1}{2}x + 2$$

$$-(x^2 + 3\frac{1}{2}x - 2)$$

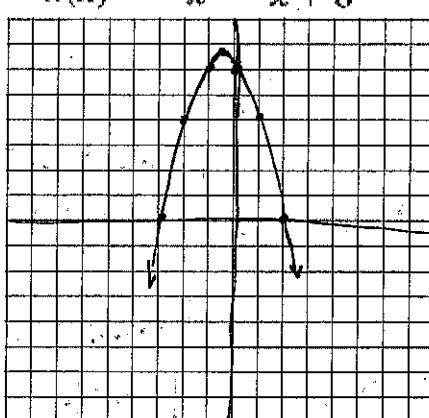
Graph each function and give the approximate coordinates of the vertex.

16. $k(x) = 4x^2 - 3$



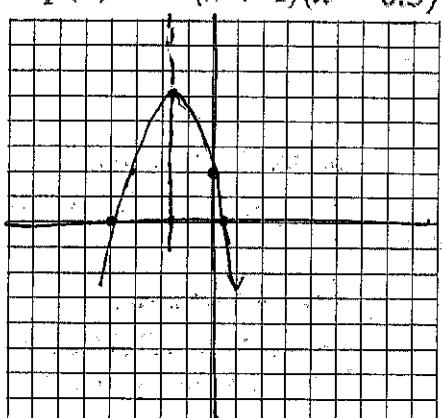
$$(0, 3)$$

17. $h(x) = -x^2 - x + 6$



$$\left(-\frac{1}{2}, 6\frac{1}{4}\right)$$

18. $p(x) = -(x+4)(x-0.5)$



$$\left(-\frac{7}{4}, 5\frac{1}{6}\right) \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-1) \pm \sqrt{1 - 4(-1)(-2)}}{2(-1)} = \frac{-(-1) \pm \sqrt{1 - 8}}{2(-1)} = \frac{-(-1) \pm \sqrt{-7}}{2(-1)}$$

Tell whether each statement is true or false.

19. The graph of a quadratic function is always a parabola.

T

20. The graphs of all quadratic functions open upward.

F

21. The graph of $f(x) = x^2$ has a maximum value at (0, 0).

F

Identify the axis of symmetry of the graph of each function. Write the coordinates of the vertex.

22. $f(x) = -3(x+1)^2 - 7$ $x = -1$ $(-1, -7)$

23. $g(x) = x^2 - 4x + 2$ $x = 2$ $(2, -2)$

24. $h(x) = -8x^2 + 12x - 11$ $x = \frac{3}{4}$ $(\frac{3}{4}, -6\frac{1}{2})$

25. $k(x) = -4(x+3)^2 + 9$ $x = -3$ $(-3, 9)$

For each function, (a) determine whether the graph opens upward or downward, (b) find the axis of symmetry, (c) find the vertex, and (d) find the y-intercept. Then graph the function.

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

27. $g(x) = 2x^2 + 4x - 2$

down

a. Upward or downward

$x = 1\frac{1}{2} \approx -\frac{3}{2}$

b. Axis of symmetry

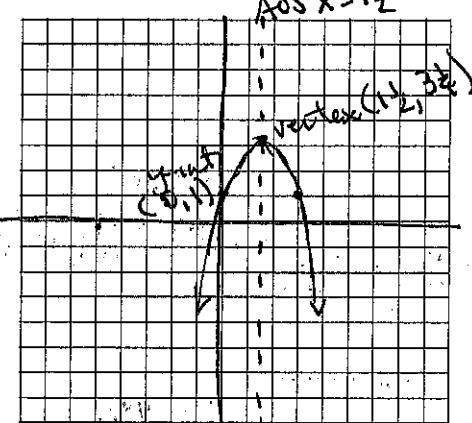
$(1\frac{1}{2}, 3\frac{1}{4})$

c. Vertex

1

d. y-intercept

AOS $x = 1\frac{1}{2}$



up

$x = -1$

a. Upward or downward

b. Axis of symmetry

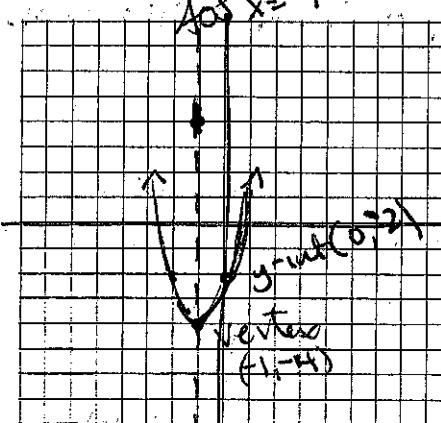
$(-1, -4)$

c. Vertex

-2

d. y-intercept

AOS $x = -1$



Find the minimum or maximum value of each function WITHOUT a calculator.

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

$$x = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$$

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

$$\boxed{y = 0}$$

min

Solve.

30. Write the vertex form of a quadratic function that opens upward and a y-intercept of 3.

ex: $y = (x+3)^2 - 6$

or $y = (x-7)^2 - 46$

31. The vertex of the function $g(x) = 4x^2 + bx + 16$ is at $(2, 0)$. Find the value of b for the function.

$$x = \frac{-b}{2(4)} = 2$$

$$\begin{aligned} \frac{-b}{8} &= 2 \\ +b &= 16 \\ b &= -16 \end{aligned}$$

$$\boxed{\text{max}}$$

32. The y-intercept of function $g(x) = 2(x-3)^2 + k$ is -2 . Find the value of k .

$$\begin{aligned} g(x) &= 2(x^2 - 6x + 9) + k \\ &= 2x^2 - 12x + 18 + k \end{aligned}$$

$$\begin{aligned} 18 + k &= c \\ 18 + k &= -2 \\ -18 & \quad -18 \\ k &= 20 \end{aligned}$$

33. An airline sells a 3-day vacation package. Sales from this vacation package can be modeled by the quadratic function $s(p) = -40p^2 + 32000p$. Sales are dependent on the price, p , of the package. If the price is set too high, the package won't sell, but if the price is too low, prospective buyers will think it is a scam.

$$(x, y) = (p, s) \quad \text{max}$$

A. At what price, p , does the company have the greatest revenue?

$$p = \frac{-(32000)}{2(-40)} = \frac{16000}{80} \quad \boxed{\text{Price} = 400}$$

B. What are the maximum sales possible based on this model?

$$s = -40(400)^2 + 32000(400)$$

$$\boxed{\text{Sales} = 6400000}$$

c. What is the revenue from the vacation package if the price is set at \$800?

$$s = -40(800)^2 + 32000(800) = \boxed{\$0}$$

34. A record label uses the following function to model the sales of a new release: $a(t) = -90t^2 + 8100t$. The number of albums sold is a function of time, t , in days. $(x, y) \approx (t, a)$

A. On which day were the most albums sold?

$$t = \frac{-(8100)}{2(-90)} = \frac{8100}{180} = \boxed{45} \quad \boxed{\text{45 days after release}}$$

B. What is the maximum number of albums sold on that day?

$$a = -90(45)^2 + 8100(45) = \boxed{182,250 \text{ albums}}$$