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MATH 195

§3.1 QUADRATIC FUNCTIONS

\# 3, 5, 15, 19, 23, 27, 37, 42-44

3. UPWARD, (2, -6), -6, MINIMUM

5. (a) VERTEX: (3, 4)

Y-INTERCEPT: -5

X-INTERCEPTS: 1, 5

(b) MAX VALUE 4

(c) DOMAIN: $(-\infty, \infty)$

RANGE: $(-\infty, 4]$

15. (a) $f(x) = x^2 + 4x + 3$

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

$\boxed{f(x) = (x+2)^2 - 1}$

(b) VERTEX: (-2, -1)

Y-INT: 3

X-INT: $0 = (x+2)^2 - 1$

$1 = (x+2)^2$

$\pm\sqrt{1} = x + 2$

$\boxed{x = -2 \pm 1 = -3, -1}$

(c) MIN VALUE -1

19. $f(x) = 2x^2 + 4x + 3$

$= 2(x^2 + 2x) + 3$

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

$\boxed{f(x) = 2(x+1)^2 + 1}$

(b) VERTEX: $(-1, 1)$

Y-INT: 3

X-INT: $0 = 2(x+1)^2 + 1$

$-\frac{1}{2} = (x+1)^2$ NO SOLUTIONS!

NONE

(c) MIN VALUE 1

23. $f(x) = -4x^2 - 12x + 1$

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

$= -4\left(x + \frac{3}{2}\right)^2 + 9 + 1$

$\boxed{f(x) = -4\left(x + \frac{3}{2}\right)^2 + 10}$

(b) VERTEX: $\left(-\frac{3}{2}, 10\right)$

(c) MAX VALUE 10

Y-INT: 1

X-INT: $0 = -4\left(x + \frac{3}{2}\right)^2 + 10$

$\frac{5}{2} = \left(x + \frac{3}{2}\right)^2$

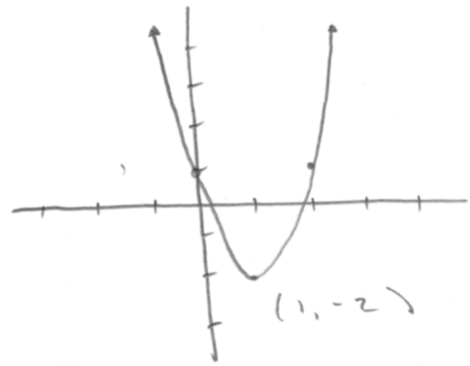
$\boxed{x = -\frac{3}{2} \pm \sqrt{\frac{5}{2}}}$

27. $f(x) = 3x^2 - 6x + 1$

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

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

$$\boxed{f(x) = 3(x-1)^2 - 2}$$



MIN VALUE -2

37. $f(t) = -20t^2 + 80t - 3$

$f\left(-\frac{b}{2a}\right) = f\left(-\frac{80}{2(-40)}\right) = f(2) = -20(2)^2 + 80(2) - 3$

$= -80 + 160 - 3 = 77$

MAX VALUE 77

42. $f(x) = -\frac{1}{3}x^2 + 2x + 7$

$f\left(-\frac{b}{2a}\right) = f\left(-\frac{2}{2(-\frac{1}{3})}\right) = f(3) = -\frac{1}{3}(3)^2 + 2(3) + 7$

$= -3 + 6 + 7 = 10$

MAX VALUE 10

43. $f(x) = -\frac{1}{2}x^2 - x + 3$

$$f\left(-\frac{b}{2a}\right) = f\left(-\frac{(-1)}{2(-\frac{1}{2})}\right) = f(-1) = -\frac{1}{2}(-1)^2 - (-1) + 3$$

$$= -\frac{1}{2} + 1 + 3 = \frac{7}{2}$$

MAX VALUE $\frac{7}{2}$

44. $g(x) = 2x(x-4) + 7$

$$= 2x^2 - 8x + 7$$

$$f\left(-\frac{b}{2a}\right) = f\left(-\frac{(-8)}{2(2)}\right) = f(2) = 2(2)^2 - 8(2) + 7$$

$$= 8 - 16 + 7 = -1$$

MIN VALUE -1