

Solve.

1) $3x^2 = 45$

$$x^2 = \frac{45}{3}$$

$$x^2 = 15$$

$$x = \pm \sqrt{15}$$

2) $49x^2 + 25 = 0$

$$49x^2 = -25$$

$$x^2 = \frac{-25}{49}$$

$$x = \pm \sqrt{\frac{-25}{49}}$$

$$x = \pm \frac{5}{7}i$$

3) $\left(x + \frac{2}{5}\right)^2 = \frac{23}{25}$

$$x + \frac{2}{5} = \pm \sqrt{\frac{23}{25}}$$

$$x + \frac{2}{5} = \pm \sqrt{\frac{23}{5}}$$

$$x = -\frac{2}{5} \pm \frac{\sqrt{23}}{5}$$

4) Let $f(x) = (x + 2)^2$. Find x so that $f(x) = 42$.

$$(x+2)^2 = 42$$

$$x+2 = \pm \sqrt{42}$$

$$x = -2 \pm \sqrt{42}$$

Solve by completing the square.

5) $z^2 + 14z + 38 = 0$

$$z^2 + 14z = -38$$

$$z^2 + 14z + 49 = -38 + 49$$

$$(z + 7)^2 = 11$$

$$(z + 7) = \pm \sqrt{11}$$

$$z = -7 \pm \sqrt{11}$$

6) $2x^2 + 7x + 3 = 0$

$$2x^2 + 7x = -3$$

$$x^2 + \frac{7}{2}x = -\frac{3}{2}$$

$$x^2 + \frac{7}{2}x + \frac{49}{16} = -\frac{3}{2} + \frac{49}{16}$$

$$(x + \frac{7}{4})^2 = -\frac{24}{16} + \frac{49}{16}$$

$$(x + \frac{7}{4})^2 = \frac{25}{16}$$

$$x + \frac{7}{4} = \pm \sqrt{\frac{25}{16}}$$

$$x + \frac{7}{4} = \pm \frac{5}{4}$$

$$x = -\frac{7}{4} \pm \frac{5}{4}$$

$$-\frac{7}{4} + \frac{5}{4} = -\frac{2}{4} = \boxed{-\frac{1}{2}}$$

$$-\frac{7}{4} - \frac{5}{4} = -\frac{12}{4} = \boxed{-3}$$

7) $x^2 + 8x = 3$

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

$$(x + 4)^2 = 19$$

$$x + 4 = \pm \sqrt{19}$$

$$x = -4 \pm \sqrt{19}$$

Complete the square to find the x-intercepts of the function.

8) $f(x) = 5x^2 - 4x - 9$

$$5x^2 - 4x - 9 = 0$$

$$5x^2 - 4x = 9$$

$$x^2 - \frac{4}{5}x = \frac{9}{5}$$

$$x^2 - \frac{4}{5}x + \frac{4}{25} = \frac{9}{5} + \frac{4}{25}$$

$$(x - \frac{2}{5})^2 = \frac{45}{25} + \frac{4}{25}$$

$$(x - \frac{2}{5})^2 = \frac{49}{25}$$

$$x - \frac{2}{5} = \pm \sqrt{\frac{49}{25}}$$

$$x - \frac{2}{5} = \pm \frac{7}{5}$$

$$x = \frac{2}{5} \pm \frac{7}{5}$$

$$\frac{2}{5} + \frac{7}{5} = \frac{9}{5}$$

$$\frac{2}{5} - \frac{7}{5} = -\frac{5}{5} = -1$$

x-int
 $(\frac{9}{5}, 0)$ and $(-1, 0)$

Use $A = P(1+r)^t$ to find the interest rate. Round to the nearest hundredth, if necessary.

9) \$5000 grows to \$6161 in 2 years. Assume that interest is compounded annually.

A) 0.11%

B) 1.11%

C) 1.23%

D) 11%

$$6161 = 5000(1+r)^2$$

$$\frac{6161}{5000} = (1+r)^2$$

$$\pm \sqrt{\frac{6161}{5000}} = 1+r$$

$$-1 \pm \sqrt{\frac{6161}{5000}} = r$$

RATES MUST BE POSITIVE

$$\text{so } r = -1 + \sqrt{\frac{6161}{5000}}$$

$$r \approx .110$$

$$= 11\%$$

Solve.

10) $2m^2 + 8m + 3 = 0$

$a=2$ $b=8$ $c=3$

$$m = \frac{-8 \pm \sqrt{64 - 4(2)(3)}}{2(2)}$$

$$= \frac{-8 \pm \sqrt{64 - 24}}{4}$$

$$= \frac{8 \pm \sqrt{40}}{4}$$

$$= \frac{8 \pm 2\sqrt{10}}{4}$$

$$= 2 \pm \frac{1}{2}\sqrt{10}$$

11) $\frac{6}{x} + \frac{6}{x+9} = 1$

$$x(x+9) \left(\frac{6}{x} + \frac{6}{x+9} \right) = 1(x)(x+9)$$

$$6(x+9) + 6x = x^2 + 9x$$

$$6x + 54 + 6x = x^2 + 9x$$

$$12x + 54 = x^2 + 9x$$

$$0 = x^2 - 3x - 54$$

$$(x-9)(x+6) = 0$$

$$x-9=0 \quad x+6=0$$

$$x=9 \quad x=-6$$

12) $14(x-4) - (x-22) = (x+2)(x-4)$

$$14x - 56 - x + 22 = x^2 - 2x - 8$$

$$13x - 34 = x^2 - 2x - 8$$

$$0 = x^2 - 15x + 26$$

$$0 = (x-13)(x-2)$$

$$x-13=0 \quad x-2=0$$

$$x=13 \quad x=2$$

$$13) x^3 - 27 = 0$$

$$(x-3)(x^2 + 3x + 9) = 0$$

$$x-3=0$$

$$x=3$$

$$x^2 + 3x + 9 = 0$$

$$x = \frac{-3 \pm \sqrt{9 - 4(1)(9)}}{2}$$

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

$$x = \frac{-3 \pm \sqrt{9 - 36}}{2}$$

$$x = \frac{-3 \pm \sqrt{-27}}{2}$$

SOLUTIONS

$$\left\{ 3, \frac{-3 \pm 3i\sqrt{3}}{2} \right\}$$

Use the discriminant to determine whether the following equations have solutions that are: two different rational solutions; two different irrational solutions; exactly one rational solution; or two different imaginary solutions.

$$14) s^2 + 4s - 5 = 0$$

$$a=1 \quad b=4 \quad c=-5$$

$$D = b^2 - 4ac$$

$$D = 16 - 4(1)(-5)$$

$$D = 16 + 20$$

$$D = 36 \quad \text{A perfect square}$$

2 DIFFERENT RATIONAL SOLUTIONS

$$15) t^2 + 4t + 4 = 0$$

$$a=1 \quad b=4 \quad c=4$$

$$D = b^2 - 4ac$$

$$D = 16 - 4(1)(4)$$

$$D = 16 - 16$$

$$D = 0$$

ONE RATIONAL SOLUTION

$$16) w^2 - 3w + 8 = 0$$

$$a=1 \quad b=-3 \quad c=8$$

$$D = b^2 - 4ac$$

$$D = 9 - 4(1)(8)$$

$$D = 9 - 32$$

$$D = -23 < 0$$

2 different imaginary SOLUTIONS.

Write a quadratic equation having the given numbers as solutions. (using integer coefficients)

17) $-\frac{1}{4}, -\frac{2}{3}$

$$x = -\frac{1}{4} \quad x = -\frac{2}{3}$$

$$4x = -1 \quad 3x = -2$$

$$4x + 1 = 0 \quad 3x + 2 = 0$$

$$(4x+1)(3x+2) = 0$$

$$12x^2 + 8x + 3x + 2 = 0$$

$$12x^2 + 11x + 2 = 0$$

18) 8, only solution

$$x = 8$$

$$x - 8 = 0$$

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

$$x^2 - 16x + 64 = 0$$

19) $4 - \sqrt{3}, 4 + \sqrt{3}$

$$x = 4 - \sqrt{3} \quad x = 4 + \sqrt{3}$$

$$x - 4 + \sqrt{3} = 0 \quad x - 4 - \sqrt{3} = 0$$

$$((x-4) + \sqrt{3})(x-4 - \sqrt{3}) = 0$$

$$(x-4)^2 - 3 = 0$$

$$x^2 - 8x + 16 - 3 = 0$$

$$x^2 - 8x + 13 = 0$$

Solve the formula for the indicated letter. Assume that all variables represent nonnegative numbers.

20) $A = \frac{1}{3}\pi r^2$ for r

$$3A = \pi r^2$$

$$\frac{3A}{\pi} = r^2$$

$$\sqrt{\frac{3A}{\pi}} = r \quad \text{since } r \geq 0$$

21) $rm = t^2 - mt$, for t

$$0 = t^2 - mt - rm$$

$$a=1 \quad b=-m \quad c=-rm$$

$$t = \frac{m \pm \sqrt{m^2 - 4(1)(-rm)}}{2(1)}$$

$$t = \frac{m \pm \sqrt{m^2 + 4rm}}{2}$$

Solve.

22) $(t+2)^{2/3} + 3(t+2)^{1/3} - 10 = 0$

Let $u = (t+2)^{1/3} \rightarrow u^2 = (t+2)^{2/3}$

$$u^2 + 3u - 10 = 0$$

$$(u+5)(u-2) = 0$$

$$u+5=0 \quad u-2=0$$

$$u = -5 \quad u = 2$$

$$(t+2)^{1/3} = -5$$

$$t+2 = -125$$

$$t = -127$$

$$\{-127, 6\}$$

$$(t+2)^{1/3} = 2$$

$$t+2 = 8$$

$$t = 6$$

23) $x^4 - 12x^2 + 27 = 0$

Let $u = x^2 \rightarrow u^2 = x^4$

$$u^2 - 12u + 27 = 0$$

$$(u-9)(u-3) = 0$$

$$u-9=0 \quad u-3=0$$

$$u=9 \quad u=3$$

$$x^2=9 \quad x^2=3$$

$$x = \pm 3 \quad x = \pm \sqrt{3}$$

$$\{3, -3, \sqrt{3}, -\sqrt{3}\}$$

24) $(x^2-7)^2 + 7(x^2-7) + 10 = 0$

Let $u = x^2-7$

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

$$(u+5)(u+2) = 0$$

$$u+5=0 \quad u+2=0$$

$$u = -5 \quad u = -2$$

$$x^2-7 = -5 \quad x^2-7 = -2$$

$$x^2 = 2 \quad x^2 = 5$$

$$x = \pm \sqrt{2} \quad x = \pm \sqrt{5}$$

$$\{\pm \sqrt{2}, \pm \sqrt{5}\}$$

Without graphing, find the vertex.

$$25) f(x) = -(x+3)^2 + 3$$

$$y = a(x-h)^2 + k$$

(h, k) is vertex

vertex is $(-3, 3)$

Find the axis of symmetry of the graph of the parabola.

$$26) f(x) = -(x+4)^2 + 8$$

$x = -4$ is the axis of symmetry

Without graphing, find the maximum value or minimum value.

$$27) f(x) = 0.67(x+6)^2 - 7$$

vertex = $(-6, -7)$ faces up

so min value is -7

Complete the square to write the function in the form $f(x) = a(x - h)^2 + k$.

28) $f(x) = -x^2 - 4x - 3$

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

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

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

29) $f(x) = 11x^2 + 4x + 5$

$$f(x) = 11 \left(x^2 + \frac{4}{11}x \right) + 5$$

$$f(x) = 11 \left(x^2 + \frac{4}{11}x + \frac{4}{121} \right) + 5 - \frac{4}{11}$$

$$f(x) = 11 \left(x + \frac{2}{11} \right)^2 + \frac{55}{11} - \frac{4}{11}$$

$$f(x) = 11 \left(x + \frac{2}{11} \right)^2 + 5\frac{1}{11}$$

Find the vertex.

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

$$x = \frac{-b}{2a} = \frac{4}{2(2)} = \frac{4}{4} = 1$$

$$y(1, -4)$$

$$f(1) = 2(1)^2 - 4(1) - 2$$

$$= 2 - 4 - 2$$

$$= 2 - 6$$

$$= -4$$

Find the line of symmetry.

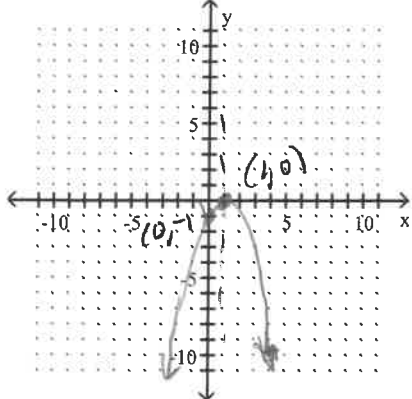
31) $f(x) = 3x^2 - 18x + 22$

$$x = \frac{-b}{2a} = \frac{-(-18)}{2(3)} = \frac{18}{6} = 3$$

$$x = 3$$

Graph. Label the vertex, axis of symmetry and at least one other point on the graph.

32) $f(x) = -x^2 + 2x - 1$



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

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

V (1, 0)
 faces down
 (0, -1)

Find the x- and y-intercepts. If no x-intercepts exist, state so.

33) $f(x) = 6x^2 + 10x + 2$

$f(0) = 2$ (0, 2) y-intercept

$$6x^2 + 10x + 2 = 0$$

$$x = \frac{-10 \pm \sqrt{100 - 4(6)(2)}}{2(6)}$$

$$x = \frac{-10 \pm \sqrt{100 - 48}}{12}$$

$$x = \frac{-10 \pm \sqrt{52}}{12}$$

$$x = \frac{-10 \pm 2\sqrt{13}}{12}$$

$$x = \frac{-5 \pm \sqrt{13}}{6}$$

$(\frac{-5 + \sqrt{13}}{6}, 0)$ $(\frac{-5 - \sqrt{13}}{6}, 0)$ ← x-int

Solve.

34) The length and width of a rectangle have a sum of 72. What dimensions give the maximum area?

$$L + W = 72$$

$$W = 72 - L$$

$$\text{Area} = LW$$

$$\text{Area} = L(72 - L)$$

$$\text{Area} = 72L - L^2$$

has a max value
at the vertex

$$\text{Area} = -L^2 + 72L$$

$$L = \frac{-72}{-2} = 36$$

$$W = 72 - L = 36$$

35) What is the minimum product of two numbers whose difference is 76?

$$x - y = 76$$

$$x = 76 + y$$

product = xy

product = $x(y) = (76+y)(y) = 76y + y^2$

min at vertex

$$y = \frac{-b}{2a} = \frac{-76}{2} = -38$$

$$x = 76 - 38 = 38$$

$$\text{product} = (38)(-38) = -1444$$

Solve. Provide answers in interval notation for all of the following inequalities

36) $p^2 - 4p + 3 > 0$

$$(p-3)(p+1) > 0$$

critical #s

$$p = 3 \quad p = -1$$



II test $p = 0$
 $(0-3)(0+1) > 0$
 false

III test $p = 4$
 $(4-3)(4+1) > 0$
 true

I test $p = -2$

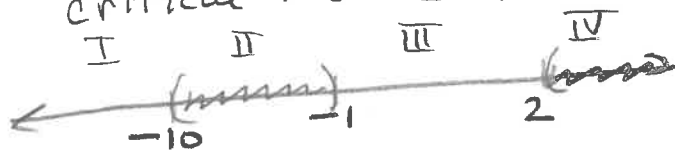
$$(-2-3)(-2+1) > 0 \text{ true}$$

$$\boxed{(-\infty, -1) \cup (3, \infty)}$$

37) $(a+10)(a+1)(a-2) > 0$

critical #s

$$\{-10, -1, 2\}$$



II test $a = -2$

$$(-2+10)(-2+1)(-2-2) > 0 \text{ true}$$

III test $a = 0$
 $(0+10)(0+1)(0-2) > 0$ false

IV test $a = 3$
 $(3+10)(3+1)(3-2) > 0$ true

I-test $a = -11$

$$(-11+10)(-11+1)(-11-2) > 0$$

false

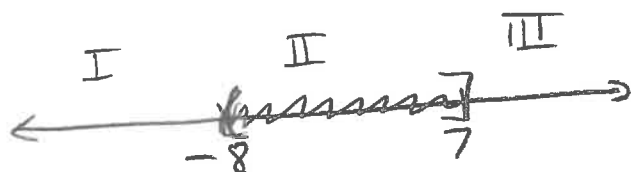
SOLUTION

$$\boxed{(-10, -1) \cup (2, \infty)}$$

38) $\frac{x-7}{x+8} \leq 0$

critical numbers

$$7, -8$$



I test $x = -9$

$$\frac{(-9-7)}{-9+8} \leq 0 \text{ false}$$

III test $x = 8$

$$\frac{8-7}{8+8} \leq 0 \text{ false}$$

II test $x = 0$

$$\frac{0-7}{0+8} \leq 0 \text{ true}$$

SOLUTION $\boxed{[-8, 7]}$

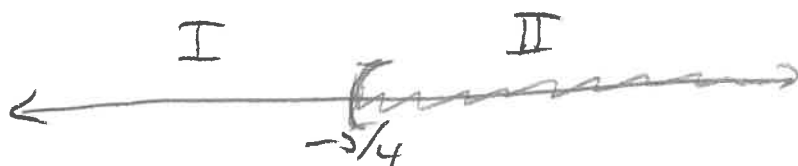
$$39) \frac{4x+5}{2x^2+5} > 0$$

Since $2x^2+5 \neq 0$

only critical # is where

$$4x+5=0$$

$$x = -5/4$$



I TEST $x = -2$

$$\frac{(4)(-2)+5}{(2(-2)^2+5)} = \frac{-8+5}{4+5} > 0 \text{ False}$$

II TEST $x = 0$

$$\frac{4(0)+5}{2(0)^2+5} > 0 \text{ TRUE}$$

SOLUTION $(-5/4, \infty)$