

Simplify the following expressions.

<p>1) <math>(3-2i)(4+5i)</math>  <math>12 + 15i - 8i - 10i^2</math>  <math>12 + 7i + 10</math>  <math>22 + 7i</math></p>	<p>2) <math>(2\sqrt{-6})(-6\sqrt{-18})</math>  <math>(2i\sqrt{6})(-18i\sqrt{2})</math>  <math>-36i^2\sqrt{12}</math>  <math>36\sqrt{4 \cdot 3}</math>  <math>72\sqrt{3}</math></p>	<p>3) <math>\frac{3-i}{4-2i} \cdot \frac{4+2i}{4+2i}</math>  <math>= \frac{12 + 6i + 4i + 2i^2}{16 - 4i^2}</math>  <math>= \frac{10 + 10i}{20}</math>  <math>= \frac{1}{2} + \frac{1}{2}i</math></p>
<p>4) <math>\sqrt{-90}</math>  <math>= 3i\sqrt{10}</math></p>	<p>5) <math>(4+i) - (2+i)</math>  <math>= 2</math></p>	<p>6) <math>\frac{4}{i+2} \cdot \frac{-i+2}{-i+2}</math>  <math>= \frac{-4i + 8}{-i^2 + 4}</math>  <math>= \frac{-4i + 8}{5}</math>  <math>= \frac{8}{5} - \frac{4}{5}i</math></p>

Find the values of  $x$  and  $y$  that make the equation true.

<p>7) <math>2x + 4yi = 12 - 16i</math>  <math>2x = 12</math>      <math>4y = -16</math>  <math>x = 6</math>      <math>y = -4</math></p>	<p>8) <math>2x - (3+i) = 4 + 2yi</math>  <math>2x - 3 - i = 4 + 2yi</math>  <math>2x - 3 = 4</math>      <math>-1 = 2y</math>  <math>2x = 7</math>      <math>-\frac{1}{2} = y</math>  <math>x = \frac{7}{2}</math></p>
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Find the zeros of the following functions:

<p>9) <math>f(x) = 5x^2 - 20x + 20</math></p> $0 = x^2 - 4x + 4$ $0 = (x-2)^2$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <math>x = 2</math> </div>	<p>10) <math>y = 5x^2 + 16x + 3</math></p> $0 = (5x+1)(x+3)$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <math>x = -\frac{1}{5}, -3</math> </div>
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Solve the following equations for  $x$  using radicals.

<p>11) <math>3x^2 + 5 = 20</math></p> $3x^2 = 15$ $x^2 = 5$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <math>x = \pm\sqrt{5}</math> </div>	<p>12) <math>4(x+5)^2 - 10 = 6</math></p> $4(x+5)^2 = 16$ $(x+5)^2 = 4$ $x+5 = \pm 2$ $x = -5 \pm 2$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <math>x = -3, -7</math> </div>	<p>13) <math>-3x^2 + 7 = 34</math></p> $-3x^2 = 27$ $x^2 = -9$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <math>x = \pm 3i</math> </div>
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Solve the following equations by completing the square.

<p>14) <math>-2x^2 - 5 = -x</math></p> $x^2 - \frac{1}{2}x + \frac{5}{2} = 0$ $x^2 - \frac{1}{2}x = -\frac{5}{2}$ $x^2 - \frac{1}{2}x + \frac{1}{16} = -\frac{5}{2} + \frac{1}{16}$ $(x - \frac{1}{4})^2 = \frac{-39}{16}$ $x - \frac{1}{4} = \pm i \frac{\sqrt{39}}{\sqrt{16}}$ $x = \frac{1}{4} \pm i \frac{\sqrt{39}}{4}$	<p>15) <math>x^2 - 8x = -14</math></p> $x^2 - 8x + 16 = -14 + 16$ $(x-4)^2 = 2$ $x-4 = \pm\sqrt{2}$ <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <math>x = 4 \pm \sqrt{2}</math> </div>
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$$x = \frac{1 \pm i\sqrt{39}}{4}$$

Solve the following by using the Quadratic Formula.

<p>16) <math>x^2 - \frac{3}{5}x = \frac{-2}{25}</math></p> $x^2 - \frac{3}{5}x + \frac{2}{25} = 0$ $x = \frac{-(-3/5) \pm \sqrt{(-3/5)^2 - 4(1)(2/25)}}{2(1)}$ $= \frac{3/5 \pm \sqrt{9/25 - 8/25}}{2}$ $= \frac{3/5 \pm 1/5}{2}$ $= \frac{4/5}{2}, \frac{2/5}{2} \quad \boxed{x = \frac{2}{5}, \frac{1}{5}}$	<p>17) <math>3x^2 + 5x = 2</math></p> $3x^2 + 5x - 2 = 0$ $x = \frac{-5 \pm \sqrt{25 - 4(3)(-2)}}{2(3)}$ $= \frac{-5 \pm \sqrt{25 + 24}}{6}$ $= \frac{-5 \pm 7}{6}$ $= \frac{-12}{6}, \frac{2}{6}$ $\boxed{x = -2, \frac{1}{3}}$
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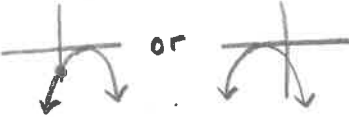

Write the following quadratic functions in Vertex Form. State the vertex and intercepts.

<p>18) <math>y = -x^2 - 4x + 15</math></p> $-y = x^2 + 4x - 15$ $-y = (x^2 + 4x + 4) - 15 - 4$ $-y = (x + 2)^2 - 19$ $y = -(x + 2)^2 + 19$ <p>vertex: <math>(-2, 19)</math></p> <p>y-int: <math>(0, 15)</math></p> <p>x-int: <math>(-2 + \sqrt{19}, 0)</math> &amp; <math>(-2 - \sqrt{19}, 0)</math></p>	<p>19) <math>y = \frac{1}{3}x^2 - 4x + 15</math></p> $3y = x^2 - 12x + 45$ $3y = (x^2 - 12x + 36) + 45 - 36$ $3y = (x - 6)^2 + 9$ $y = \frac{1}{3}(x - 6)^2 + 3$ <p>vertex: <math>(6, 3)</math></p> <p>y-int: <math>(0, 15)</math></p> <p>x-int: <math>(6 + 3i, 0)</math> and <math>(6 - 3i, 0)</math></p>
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$0 = \frac{1}{3}(x-6)^2 + 3$   
 $-9 = (x-6)^2$   
 $\pm 3i = x-6$   
 $6 \pm 3i = x$

Describe the nature of the roots of each quadratic equation.

<p>20) <math>0 = -x^2 + 6x - 9</math></p> $b^2 - 4ac = 6^2 - 4(-1)(-9)$ $= 36 - 36$ $= 0$ <p>1 Rational Root</p>	<p>21) <math>0 = -2x^2 + 3x - 2</math></p> $3^2 - 4(-2)(-2)$ $9 - 16$ $-7$ <p>2 Nonreal Complex Roots</p>
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<p>22) Describe the <u>nature of the roots</u> if a parabola has a discriminant of <math>-49</math>.</p> <p>2 nonreal complex roots</p>	<p>23) How many <u>x-intercepts</u> will a parabola have if its vertex is in quadrant 3 and the value of "a" is <math>-2</math>. <sup>open</sup> <sub>down</sub></p> <p>2 nonreal complex roots</p> 	<p>24) A parabola whose vertex is in quadrant 1 has a discriminant of <math>23</math>. Describe the <u>x-intercepts</u>.</p> <p>2 irrational roots</p>
<p>25) A quadratic function has only one x-intercept and a y-intercept <math>(0, -3)</math>. Describe the value of "a."</p>  <p>a is neg so parabola opens down</p>	<p>26) The graph of a quadratic function has 2 rational roots. What can you conclude about the <u>value</u> of the discriminant?</p> <p>the discriminant is a perfect square</p>	<p>27) The discriminant of a quadratic equation is <math>0</math>. What can you conclude about the <u>vertex</u> of the parabola?</p> <p>the vertex is on the x-axis</p>
<p>28) The vertex of a parabola is in quadrant 4 and the coefficient "a" is negative. What can you conclude about the <u>nature of the roots</u>?</p>  <p>2 - nonreal complex roots</p>	<p>29) The graph of a quadratic function has 1 rational root. What can you conclude about the <u>value</u> of the discriminant?</p> <p>the discriminant is 0</p>	<p>30) The graph of a quadratic function has 2 imaginary roots. What can you conclude about the <u>value</u> of the discriminant? Describe the <u>x-intercepts</u>.</p> <p>the discriminant is negative The parabola doesn't cross the x-axis</p>

$$31) -4y = x^2 + 8x + 24$$

$$0 = -\frac{1}{4}(x+4)^2 - 2$$

$$-4y = (x^2 + 8x + 16) + 24 - 16$$

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

$$y = -\frac{1}{4}(x+4)^2 - 2$$

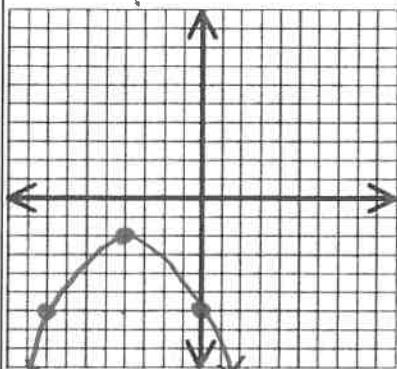
$$-4 \pm 2i\sqrt{2} = x$$

Graph the following Parabolas. Answer the related questions.

$$31) y = -\frac{1}{4}x^2 - 2x - 6$$

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

$$y(-4) = -\frac{1}{4}(-4)^2 - 2(-4) - 6 = -4 + 8 - 6 = -2$$



Vertex  $(-4, -2)$

x-int(s)  $(-4 + 2\sqrt{2}, 0)$  and  $(-4 - 2\sqrt{2}, 0)$

y-int  $(0, -6)$

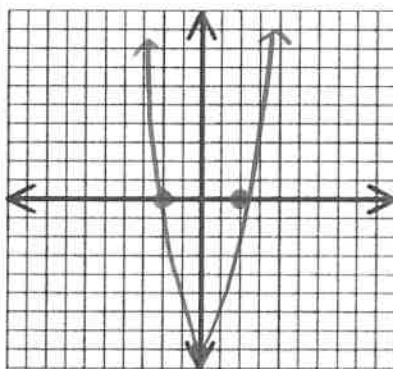
Domain  $(-\infty, \infty)$

$$32) y = 2(x-2)(x+2)$$

$$y = 2(0-2)(0+2)$$

$$y = -8$$

\* AOS  $\frac{1}{2}$  way \*  
pt between x-int



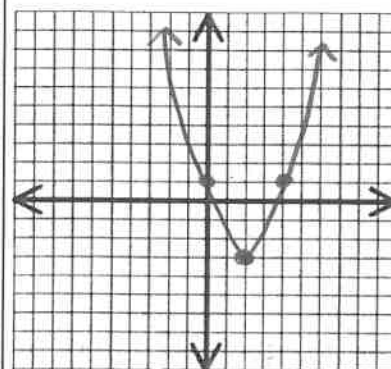
Vertex  $(0, -8)$

Max/Min  $(0, -8)$

y-int  $(0, -8)$

x-int(s)  $(2, 0)$  &  $(-2, 0)$

$$33) y = (x-2)^2 - 3$$



Vertex  $(2, -3)$

Range  $[2, \infty)$

AOS  $x = 2$

y-int  $(0, 1)$

Convert the following functions into Standard Form:

$$34) y = \frac{2}{5}(x-10)(x+5)$$

$$y = \frac{2}{5}(x^2 - 5x - 50)$$

$$y = \frac{2}{5}x^2 - 2x - 20$$

$$35) g(x) = 2(x-3)^2 - 12$$

$$g(x) = 2(x^2 - 6x + 9) - 12$$

$$= 2x^2 - 12x + 18 - 12$$

$$= 2x^2 - 12x + 6$$

Write a quadratic function in standard form whose graph has the given characteristics.

36) x-intercepts:  $(-2, 0)$  and  $(\frac{3}{2}, 0)$   
point on graph:  $(4, \frac{15}{2})$   $x = \frac{3}{2}$   
 $2x - 3 = 0$

$$y = a(x+2)(2x-3)$$

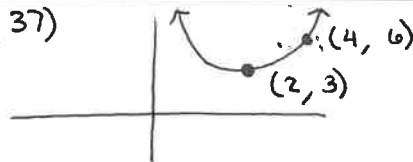
$$\frac{15}{2} = a(4+2)(2(4)-3)$$

$$15/2 = a(6)(5)$$

$$\frac{15}{2} = 30a$$

$$\frac{1}{4} = a$$

$$y = \frac{1}{4}(x+2)(2x-3)$$



$$y = a(x-2)^2 + 3$$

$$6 = a(4-2)^2 + 3$$

$$3 = 4a$$

$$\frac{3}{4} = a$$

$$y = \frac{3}{4}(x-2)^2 + 3$$

Write the function in vertex form in order to graph the parabola and find the following.

38)  $y = \frac{1}{4}x^2 - 4x + 6$  Vertex Form:  $y = \frac{1}{4}(x-8)^2 - 10$

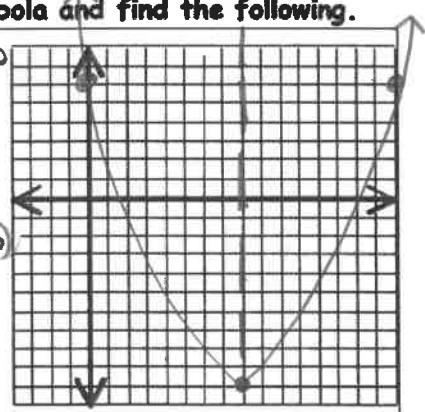
$4y = x^2 - 16x + 24$  Vertex:  $(8, -10)$

$4y = (x^2 - 16x + 64) + 24 - 64$  x-intercept(s):  $(8+2\sqrt{10}, 0)$   
 $(8-2\sqrt{10}, 0)$

$4y = (x-8)^2 - 40$  AOS:  $x = 8$

$y = \frac{1}{4}(x-8)^2 - 10$  y-intercept:  $(0, 6)$

$(8, -10)$  Max / Min:  $(8, -10)$



$0 = \frac{1}{4}(x-8)^2 - 10$   
 $+40 = (x-8)^2$   
 $8 \pm 2\sqrt{10} = x$

Graph the quadratic inequality.

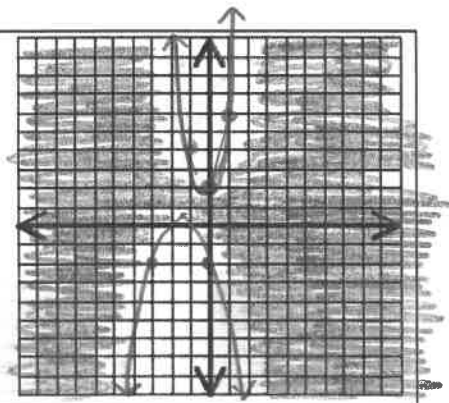
39)  $y = 3x^2 + x + 2$

$y \geq -x^2 - 3x - 2$

AoS =  $\frac{-1}{2(3)} = -\frac{1}{6}$

AoS =  $\frac{-(-3)}{2(-1)} = -\frac{3}{2}$

x	y	x	y
0	2	0	-2
1	6	-3/2	1/4
-1	4		
-1/6	23/12		



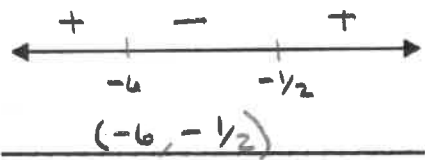
Solve each quadratic inequality. State the final solution in inequality notation.

40)  $2x^2 + 13x < -6$

$2x^2 + 13x + 6 < 0$

$(2x + 1)(x + 6) < 0$

$x = -1/2, -6$

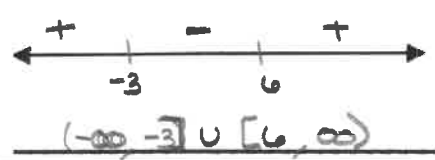


41)  $x^2 - 18 \geq 3x$

$x^2 - 3x - 18 \geq 0$

$(x-6)(x+3) \geq 0$

$x = 6, -3$



42) A thrown ball hits the ground and bounces along a parabolic path given by

$y = \frac{-2}{9}x^2 + \frac{52}{9}x - \frac{320}{9}$  where  $x$  is measured in feet.

What is the maximum height that the ball reaches on this bounce?

$x = \frac{-52/9}{2(-2/9)} = \frac{52/9}{4/9} = \frac{52}{9} \cdot \frac{9}{4} = \frac{52}{4} = 13$

$y = -\frac{2}{9}(13)^2 + \frac{52}{9}(13) - \frac{320}{9} = 2$

max height = 2 at  $x = 13$