11/7/19

The objective today is to write equations given the roots of a quadratic. Let's work backwards to see how to do this.

Solve the following quadratics by factoring. $3x^2 - 10x + 3 = 0$

Solve for the roots

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

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

$4x^2 + 4x - 3 = 0$

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

$\frac{4x^2+4x}{4} = \frac{3}{4}$

$x^2 + x = \frac{3}{4}$

$x^2 + 1x + \frac{1}{4} = \frac{3}{4} + \frac{1}{4}$

$(\frac{1}{2})^2$

$\sqrt{(x+\frac{1}{2})^2} = \sqrt{1}$

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

$x + \frac{1}{2} = 1$ $\quad -\frac{1}{2} \; -\frac{1}{2}$ $\quad \boxed{x = \frac{1}{2}}$

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

2) $3x^2 = -3 + 10x$

$(3x-1)(x-3)$

$x = \frac{1}{3}$ $x = 3$

$3x - 1 = 0$

$x = \frac{1}{3}$

Nov 7-8:24 AM

Writing equations given the roots/zeros

Given that the roots of a quadratic are $x = 2$ and $x = 7$, what is the standard form of the function?

$(x-2)(x-7) = 0$ $\quad x = 2$ $\quad (x-2) = 0$ $\quad (x-7) = 0$

$x^2 - 9x + 14 = f(x)$

Given that the roots of a quadratic are $x = -3$ and $x = 3/4$, what is the standard form of the function? $\frac{9}{4}$

$4x^2 + 9x - 9$ $\quad x^2 + 2\frac{1}{4}x - 2\frac{1}{4}$

Given that the roots of a quadratic are $x = -5$ and $x = 1/4$, what is the standard form of the function?

$(x+5)(4x-1)$ $\quad 4x^2 + 19x - 5$ $\quad 4x = \frac{1}{4} \cdot 4$

$4x^2 - x + 20x - 5$ $\quad (4x-1)$

Given that the roots of a quadratic are $x = 3/5$ and $x = -1/2$, what is the standard form of the function?

$(5x-3)(2x+1) = 0$

$10x^2 - x - 3 = 0$

Nov 3-2:24 PM

Methods for finding roots/x-intercepts/zeros...

Graphing	a time consuming sometimes	integer roots
factoring	sometimes	rational roots
Square roots	sometimes	$x^2 - 25 = 0$ $(x-3)^2 + 8 = 44$ no middle term "b"
Completing the square	always	a term is 1; b is even #
Quadratic formula	always	when others don't work

Nov 7-11:06 AM

Vertex Form $\quad$ h= x-value of vertex $\quad$ k= y-value of vertex

$f(x) = a(x-h)^2 + k$ $\quad$ axis of symmetry

Standard Form $\quad$ c= y-intercept

$f(x) = ax^2 + bx + c$ $\quad h = \frac{-b}{2a}$

Solving Quadratic Functions

1. Factoring: equation must equal 0
Leading coefficient cannot be negative

2. Square Rooting: no b term only an x^2 or $(x - h)^2$

3. Completing the square: set equation equal to c value
a must equal 1 (divide by *a* value) you are creating a perfect square trinomial so that you can eventually square root to solve

4. Quadratic formula: must be in standard form and equal 0

Nov 8-8:40 AM

1. What are the roots of $2x^2 + 12x + 3 = 8x - 3$?

$-8x \quad -8x \quad +3 \quad +3$

A. $x = \frac{2 \pm i\sqrt{2}}{2}$ B. $x = \frac{-2 \pm i\sqrt{2}}{2}$

C. $x = \frac{-4 \pm i\sqrt{2}}{4}$ D. $x = \frac{1 \pm i\sqrt{2}}{2}$

$2x^2 + 4x + 3 = 0$

$\frac{-4 \pm \sqrt{4^2 - 4(2)(3)}}{2(2)}$

$\frac{-4 \pm \sqrt{16 - 24}}{4}$

$\frac{-4 \pm \sqrt{-8}}{4}$

$\frac{-4 \pm i\sqrt{8}}{4}$

$\frac{-\cancel{4}^{2} \pm \cancel{2}i\sqrt{2}}{\cancel{4}^{2}}$

Nov 7-8:33 AM

2. Solve by taking the square root.

$3\boxed{(2x+3)^2} - 8 = 100.$

$+8 \quad +8$

$\frac{3(2x+3)^2}{3} = \frac{108}{3}$

$(2x+3)^2 = 36$

$\sqrt{(2x+3)^2} = \pm\sqrt{36}$

$2x + 3 = \pm 6$

$2x + 3 = 6 \qquad 2x + 3 = -6$

$2x = 3 \qquad 2x = -9$

$x = -9/2$

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3. Given that the roots of a quadratic are $x = -\frac{1}{2}$ and $x = 3$, what is the standard form of the function?

$x = -\frac{1}{2} * 2$

$*2$

$(x-3)$

$2x = -1$

$+1 \quad +1$

$2x + 1$

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

$2x^2 - 6x + x - 3$

$2x^2 - 5x - 3$

Nov 7-8:16 AM

4. Given the following functions below, which function has the higher rate of change between the interval of [-2,4]?

rate of change $\frac{\Delta y}{\Delta x} = \frac{rise}{run} = slope$

$[-2, -4]$ when $x = -2$ $x = -4$

Equation plug in x to solve for y

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

$y = (-2)^2 - 4(-2) + 1$

$y = 13$

$y = (-4)^2 - 4(-4) + 1 = 1$

x	y
-2	13
4	1

$\frac{\Delta y}{\Delta x} = \frac{13-1}{-2-4} = \frac{12}{-6}$

$\frac{\Delta y}{\Delta x} = -2$

II.

x	-3	-2	-1	0	2	3	4	6
$h(x)$	4	22	-4	-14	-46	-68	-94	-158

x	y
-2	22
4	-94

$\frac{\Delta y}{\Delta x} = \frac{-94-22}{4-(-2)} = \frac{-116}{6} = -19\,1/3$

Function II > Function I

Function II decreases faster!

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5. Determine the discriminant and describe the type of roots for the equation. b^2-4ac

*d>0 perfect square
2 real rational solutions
*d>0 not perfect square
2 real irrational solutions
*d = 0
one real rational solution
*d<0
2 imaginary solutions

a. $-6x^2+7x-1=9$

$-6x^2+7x-10=0$

$49-4(-6)(-10)=-191$

$d=-191$ 2 imaginary solutions

b. $6x^2-5x+7=8$

$6x^2-5x-1=0$ $(-5)(-5)$

$25-4(6)(-1)=49$

$d=49$ 2 real rational

c. $x^2+2x+10=9$

$x^2+2x+1=0$

$4-4(1)(1)=0$

$d=0$ one real rational

Nov 7-8:35 AM

6. Solve by using the quadratic formula.

$8x^2=-8x+22$ $a=8$ $b=8$ $c=-22$

$8x^2+8x-22=0$

$x=\dfrac{-8\pm\sqrt{64-4(8)(-22)}}{2(8)}$

$x=\dfrac{-8\pm\sqrt{768}}{16}$ $\sqrt{256\cdot 3}$ $\sqrt{(16)^2\cdot 3}$

$x=\dfrac{-8\pm 16\sqrt{3}}{16}$

$x=\dfrac{-8}{16}\pm\dfrac{16\sqrt{3}}{16}$ $-\dfrac{1}{2}\pm\sqrt{3}$

$x=\dfrac{-1}{2}\pm\dfrac{2\cdot 1\sqrt{3}}{2\cdot 1}=\dfrac{-1}{2}\pm\dfrac{2\sqrt{3}}{2}$

$x=\dfrac{-1\pm 2\sqrt{3}}{2}$

Nov 7-8:37 AM

7. Solve by Completing the Square.

$9x^2+18x-11=7$

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

$\dfrac{9x^2}{9}+\dfrac{18x}{9}+\dfrac{\square}{9}=\dfrac{18}{9}+\dfrac{\square}{9}$

$\left(\dfrac{b}{2}\right)^2$ $\left(\dfrac{2}{2}\right)^2$

$x^2+2x+\boxed{1}=2+\boxed{1}$

$(x+1)^2=3$

$\sqrt{(x+1)^2}=\pm\sqrt{3}$

$x+1=\pm\sqrt{3}$

$x=-1\pm\sqrt{3}$

or: $-1+\sqrt{3}$; $-1-\sqrt{3}$

Nov 7-8:37 AM

8. Solve by factoring.

a. $-4x^2-45=-29x$

$-4x^2+29x-45=0$

$-(4x^2-29x+45)=0$

$-[4x^2-9x-20x+45]=0$

$-[(4x^2-9x)+(-20x+45)]=0$

$-[x(4x-9)-5(4x-9)]=0$

$-(4x-9)(x-5)=0$

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

$x=9/4$ $x=5$

b. $6x^2-17x-28=0$

180
-9 -20

-168
$2\cdot 84$
$3\cdot 56$
$4\cdot 42$
$6\cdot 28$
$7\cdot -24$

$(6x^2-24x)+(7x-28)=0$

$6x(x-4)+7(x-4)=0$

$(x-4)(6x+7)=0$

$x-4=0$ $6x+7=0$

$x=4$ $x=-7/6$

Nov 7-8:38 AM

9. Given y = $2x^2 + 12x + 14$, write the equation in vertex form. State the vertex, axis of symmetry, whether it is a maximum or minimum and the value, y-intercept, roots, domain, and range.

$h = \frac{-b}{2a}$ (h,k) vertex

$y = 2x^2 + 12x + 14$
a b c

$h = \frac{-12}{2(2)} = \frac{-12}{4} = -3 = x$

$y = 2(-3)^2 + 12(-3) + 14 = -4$

$C = 14 = y$-int!

roots, x-int, solution

$2x^2 + 12x + 14 = 0$

$a = 2 \quad b = 12 \quad c = 14$

$x = \frac{-12 \pm \sqrt{144 - 4(2)(14)}}{2(2)}$

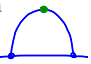
$x = \frac{-12 \pm \sqrt{144 - 112}}{4}$

$x = \frac{-12 \pm \sqrt{32}}{4} = \frac{-12 \pm 4\sqrt{2}}{4} = -3 \pm \sqrt{2}$

Vertex $(-3, -4)$
a.o.s. $x = -3$
min at $y = -4$
y-int $(0, 14)$
domain $(-\infty, \infty)$
range $[-4, \infty)$
roots $x = -3 \pm \sqrt{2}$
vertex form
$y = 2(x+3)^2 - 4$

Nov 7-8:39 AM

10. A model rocket is launched from the roof of a building. Its flight path is modeled by $h = -5t^2 + 30t + 10$ where h is the height of the rocket above the ground in meters and t is the time after the launch in seconds. What is the rocket's maximum height? How long does it take the rocket to reach its max height? How long does it take to fall back to the ground? (Round to the nearest tenths if necessary)



$h = -5t^2 + 30t + 10$ max height at vertex

$t = \frac{-b}{2a} = \frac{-30}{2(-5)} = 3$ sec

$h = -5(3)^2 + 30(3) + 10 = 55$ ft

max height at 55 ft at time 3 sec.

hits ground set $h = 0$

$-5t^2 + 30t + 10 = 0$

$t = \frac{-30 \pm \sqrt{900 - 4(-5)(10)}}{2(-5)}$

$t = \frac{-30 \pm \sqrt{1100}}{-10}$ $\sqrt{1100} \approx 33.166$

$t_1 = \frac{-30 + 33.166}{-10}$ or $t_2 = \frac{-30 - 33.166}{-10}$

$t_1 = -0.3166$ $t_2 = 6.3$ sec

Nov 7-10:28 AM

11. What is the equation, in standard form, of a parabola that contains the following points?

(–2, 27), (0, 3), (4, 51) $y = ax^2 + bx + c$

(-2, 27)
x y

$27 = a(-2)^2 + b(-2) + c$

$\boxed{27 = 4a - 2b + c}$

(4, 51)

$51 = a(4)^2 + b(4) + c$

$\boxed{51 = 16a + 4b + c}$

(0, 3)

$3 = a(0)^2 + b(0) + c$

$3 = c$

$2(24 = 4a - 2b)$

$48 = 16a + \cancel{4b}$

$48 = 8a - \cancel{4b}$

$96 = 24a$

$4 = a$

Nov 7-10:30 AM

Standard Form and Vertex form task cards

Factoring extra practice

Gone Fishing Quadratics review

Nov 6-10:02 PM