W. 10/28/2015

Advanced Algebra with Trig, Glawe Name: Key Date: _____
Solving Quadratic Functions Review (4.3, 4.4, 4.5, 4.7, 4.8, 4.9)

Find the discriminant of the function, the number and types of solutions, and solve using the quadratic formula.

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

$X = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

b^2-4ac

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

$16-16 = 0$

one real solution

$X = \frac{-4 \pm \sqrt{0}}{2(4)} = \frac{-4}{8} = -\frac{1}{2}$

$X = -1/2$

2) $y = 2x^2 + 6x + 3$

$6^2-4(2)(3)$

$36-24 = 12$

two real solutions

$\sqrt{12}$

$\sqrt{4}\ \sqrt{3}$

$2\sqrt{3}$

$X = \frac{-6 \pm \sqrt{12}}{2(2)} = \frac{-6 \pm 2\sqrt{3}}{4} =$

$X = \frac{-3 \pm \sqrt{3}}{2}$

Convert each equation from standard form of the quadratic function into vertex form by completing the square.

3) $y = x^2 + 36x - 17$

$\left(\frac{36}{2}\right)^2 = 18^2 = 324$

$y + 17 = x^2 + 36x$

$y + 17 + 324 = x^2 + 36x + 324$

$y + 341 = (x+18)^2$

$-341 \quad -341$

$y = (x+18)^2 - 341$

4) $y = 5x^2 - 70x + 163$

$\left(\frac{14}{2}\right)^2 = (7)^2 = 49$

$y - 163 = 5x^2 - 70x$

$y - 163 = 5(x^2 - 14x)$

$y - 163 + 5(49) = 5(x^2 - 14x + 49)$

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$y + 82 = 5(x-7)^2$

$y = 5(x-7)^2 - 82$

Solve the following equations by completing the square.

5) $x^2 + 4x = 10$

$\left(\frac{4}{2}\right)^2 = (2)^2 = 4$

$x^2 + 4x + 4 = 10 + 4$

$\sqrt{(x+2)^2} = \sqrt{14}$

$x + 2 = \pm\sqrt{14}$

$-2 \quad -2$

$X = -2 \pm \sqrt{14}$

6) $4x^2 - 40x - 12 = 0$

$+12 \quad +12$

$\left(\frac{-10}{2}\right)^2 = (-5)^2 = 25$

$4x^2 - 40x = 12$

$4(x^2 - 10x) = 12$

$4(x^2 - 10x + 25) = 12 + 4(25)$

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$\sqrt{28}$

$\sqrt{4}\ \sqrt{7}$

$2\sqrt{7}$

$\frac{4(x-5)^2}{4} = \frac{112}{4}$

$\sqrt{(x-5)^2} = \sqrt{28}$

$x - 5 = \pm\sqrt{28}$

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

$X = 5 \pm 2\sqrt{7}$

Solve the following equations by *using square roots.*

7) $\frac{144}{25} = \frac{25x^2}{25}$

$\sqrt{x^2} = \sqrt{\frac{144}{25}}$

$X = \pm\sqrt{\frac{144}{25}}$

$X = \pm\frac{12}{5}$

8) $25 = x^2 - 8x + 16$

$\sqrt{25} = \sqrt{(x-4)^2}$

$\pm 5 = x - 4$

$+4 \quad +4$

$X = 4 \pm 5$

$X = 4 + 5 = 9$

$4 - 5 = -1$

$X = 9, -1$

9) $7(x-4)^2 - 18 = 10$

$+18 \quad +18$

$\frac{7(x-4)^2}{7} = \frac{28}{7}$

$\sqrt{(x-4)^2} = \sqrt{4}$

$x - 4 = \pm 2$

$+4 \quad +4$

$X = 4 \pm 2$

$X = 4 + 2 = 6$

$x = 4 - 2 = 2$

$X = 6, 2$

Solve the following equations by *factoring*.

10) $144 = 25x^2$

$-144 \quad -144$

$25x^2 - 144 = 0$

$(5x-12)(5x+12)=0$

$5x-12=0$ or $5x+12=0$

$5x=12$ or $5x=-12$

$\boxed{x=12/5 \text{ or } x=-12/5}$

11) $25 = x^2 - 8x + 16$

$-25 \quad -25$

$x^2-8x-9=0$ $\quad -9 \mid -8$ / $-9, 1$

$(x-9)(x+1)=0$

$x-9=0$ or $x+1=0$

$\boxed{x=9 \text{ or } x=-1}$

12) $7x^2 - 56x + 94 = 10$

$-10 \quad -10$

$7x^2-56x+84=0$

$7(x^2-8x+12)=0$ $\quad 12 \mid -8$ / $-6, -2$

$7(x-6)(x-2)=0$

$7 \neq 0$ $\quad x-6=0$ or $x-2=0$

$\boxed{x=6 \text{ or } x=2}$

13) $12x^2 + 5x + 5 = 7$

$-7 \quad -7$

$12x^2+5x-2=0$

$a \cdot c$	b
$12 \cdot -2 = -24$	5
$8, -3$	

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

$(12x^2+8x)+(-3x-2)=0$

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

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

$4x-1=0$ or $3x+2=0$

$4x=1$ or $3x=-2$

$\boxed{x=1/4 \text{ or } x=-2/3}$

Solve the inequality algebraically.

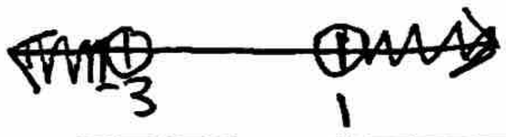
14) $x^2 + 2x - 3 > 0$

$x^2+2x-3=0$ $\quad -3 \mid 2$ / $3, -1$

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

$x+3=0$ or $x-1=0$

$x=-3$ or $x=1$



Test $x=0$:

$0^2+2(0)-3>0$

$-3>0$ ✗

$\boxed{x<-3 \text{ or } x>1}$ $\quad (-\infty,-3)\cup(1,\infty)$

15) $x^2 - 3x \leq 10$

$x^2-3x=10$ $\quad -10 \mid -3$ / $-5, 2$

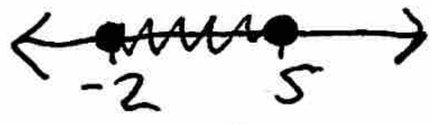
$-10 \quad -10$

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

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

$x-5=0$ or $x+2=0$

$x=5$ or $x=-2$



Test $x=0$:

$0^2-3(0)\leq 10$

$0\leq 10$ ✓

$\boxed{-2 \leq x \leq 5}$ $\quad [-2,5]$

16) A monthly magazine has 28,000 subscribers when it charges \$10 per annual subscription. For each \$1 increase in price, the magazine loses about 2000 subscribers. How much should the magazine charge to maximize annual revenue? What is the maximum annual revenue?

Annual Revenue = (number of subscribers)(subscription price)

$R(x)=(28{,}000-2000x)(10+x)$

$R(x)=(-2000x+28{,}000)(x+10)$

$R(x)=-2000(x-14)(x+10)$

$0=-2000(x-14)(x+10)$

$0\neq -2000$ $\quad x-14=0$ or $x+10=0$

$x=14$ or $x=-10$

Find the average:

$\frac{14+(-10)}{2}=\frac{4}{2}=2$

Each subscription should be \$2 + \$10 = $\boxed{\$12}$

Max annual revenue:

$R(x)=(28{,}000-2000(2))(10+2)$

$R(x)=(24{,}000)(12)=\boxed{\$288{,}000}$

17) The height y (in feet) of a baseball t seconds after it is hit is given by the function $y=-16t^2+80t+2$.

a) Find the maximum height of the baseball.

TWO WAYS TO SOLVE

completing the square: $\left(\frac{-5}{2}\right)^2=\frac{25}{4}$

$y-2=-16t^2+80t$

$y-2=-16(t^2-5t)$

$y-2-16\left(\frac{25}{4}\right)=-16\left(t^2-5t+\frac{25}{4}\right)$

$y-2-\frac{400}{4}=-16(t-5)^2$

$y-102=-16(t-5)^2$

$y=-16(t-5)^2+102$

vertex: $(5,102)$

max height: 102 feet

finding vertex in standard form:

$x=\frac{-b}{2a}=\frac{-80}{2(-16)}=\frac{-80}{-32}=\frac{80}{32}=\frac{5}{2}$

$y=-16\left(\frac{5}{2}\right)^2+80\left(\frac{5}{2}\right)+2=-16\left(\frac{25}{4}\right)+\frac{400}{2}+2=$

$\frac{-400}{4}+200+2=-100+200+2=102$

102 feet