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Date _____
Pre Calculus

Unit 3 Quadratics Review Sheet

Solve the following quadratic equations for all values of x in simplest radical form or simplest *a+bi* form if necessary.

1. $5x^2 + 60 = 0$

no x term isolate/square root

$-60 \quad -60$

$\frac{5x^2}{5} = \frac{-60}{5}$

$\sqrt{x^2} = \sqrt{-12}$

$x = \pm i\sqrt{12}$

$\pm i\sqrt{4}\sqrt{3}$

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

2. $-3x^2 - 50 = 130$

$+50 \quad +50$

$\frac{-3x^2}{-3} = \frac{180}{-3}$

$\sqrt{x^2} = \sqrt{-60}$

$x = \pm i\sqrt{60}$

$x = \pm i\sqrt{60}$

$\sqrt{4}\sqrt{15}$

$x = \pm 2i\sqrt{15}$

3. $a^2 - 8a = 20$

$-20 \quad -20$

$a^2 - 8a - 20 = 0$

$(a-10)(a+2) = 0$

$a = 10 \quad a = -2$

4. $2x^2 + 3x = 5$

$-5 \quad -5$

$2x^2 + 3x - 5 = 0$

$(2x^2 + 5x)(-2x - 5)$

$x(2x+5) - 1(2x+5)$

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

$x - 1 = 0 \quad 2x + 5 = 0$

$+1 \quad +1 \quad -5 \quad -5$

$x = 1 \quad \frac{2x}{2} = \frac{-5}{2}$

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

Solve the following using *both* the quadratic formula and completing the square methods

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

$\left(\frac{3}{2}\right)^2 = \frac{9}{4}$

8. $x^2 - 6x + 4 = 0$

Completing the square

$x^2 - 6x + 4 = 0$

$-4 \quad -4$

$x^2 - 6x = -4$

$\left(\frac{-6}{2}\right)^2 = 9$

$x^2 - 6x + 9 = -4 + 9$

$\sqrt{(x-3)^2} = \sqrt{5}$

$x - 3 = \pm\sqrt{5}$

$+3 \quad +3$

$x = 3 \pm \sqrt{5}$

quadratic formula

$x^2 - 6x + 4 = 0$

$a = 1 \quad b = -6 \quad c = 4$

$x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(4)}}{2(1)}$

$x = \frac{6 \pm \sqrt{20}}{2}$

$\sqrt{20}$

$\sqrt{4}\sqrt{5}$

$2\sqrt{5}$

$x = \frac{6 \pm 2\sqrt{5}}{2}$

$x = 3 \pm \sqrt{5}$

8. $4x^2 + 12x = 7$

Completing the square

$\frac{4x^2 + 12x}{4} = \frac{7}{4}$

$x^2 + 3x + \frac{9}{4} = \frac{7}{4} + \frac{9}{4}$

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

$x + \frac{3}{2} = \pm 2$

$-\frac{3}{2} \quad -\frac{3}{2}$

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

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

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

quadratic formula

$4x^2 + 12x = 7$

$-7 \quad -7$

$4x^2 + 12x - 7 = 0$

$a = 4 \quad b = 12 \quad c = -7$

$x = \frac{-12 \pm \sqrt{(12)^2 - 4(4)(-7)}}{2(4)}$

$x = \frac{-12 \pm \sqrt{256}}{8}$

$x = \frac{-12 \pm 16}{8}$

$x = \frac{-12 + 16}{8} = \frac{1}{2}$

$x = \frac{-12 - 16}{8} = -\frac{7}{2}$

Solve the following polynomial equations for all values of x in simplest radical form or *a+bi* form if necessary

9. $x^4 - 4x^2 - 32 = 0$

$(x^2-8)(x^2+4)=0$

$x^2-8=0$ | $x^2+4=0$

$+8\ +8$ | $-4\ -4$

$\sqrt{x^2}=\sqrt{8}$ | $\sqrt{x^2}=\sqrt{-4}$

$x=\pm\sqrt{8}$ | $x=\pm 2i$

$\sqrt{4}\cdot\sqrt{2}$

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

10. $x^3 - 3x^2 - 5x + 15 = 0$

$x^2\ x^2\ -5\ -5$

$x^2(x-3)-5(x-3)=0$

$(x^2-5)(x-3)=0$

$x^2-5=0$ | $x-3=0$

$+5\ +5$ | $+3\ +3$

$\sqrt{x^2}=\sqrt{5}$ | $x=3$

$x=\pm\sqrt{5}$

Solve the following inequalities and graph on a number line

11. $x^2 \le 4x + 12$ → convergent

$-4x-12\ \ -4x-12$

$x^2-4x-12=0$

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

$x=6$ | $x=-2$

$-2\le x\le 6$

$[-2,6]$

12. $3x^2 + 2x \le 8$ → convergent

$-8\ \ -8$

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

$(3x^2+6x)(-4x-8)$

$3x\ 3x$ | $-4\ -4$

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

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

$3x-4=0$ | $x+2\neq 0$

$+4\ +4$ | $-2\ -2$

$\frac{3x}{3}=\frac{4}{3}$ | $x=-2$

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

$-2\le x\le \frac{4}{3}$ $\quad [-2,\frac{4}{3}]$

13. $x^4 - 20x^2 < 64$

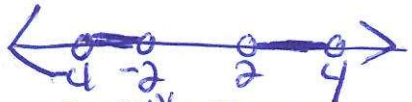
$+64\ +64$

$x^4-20x^2+64=0$

$(x^2-16)(x^2-4)=0$

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

$x=-4$ | $x=4$ | $x=-2$ | $x=2$



$(x+4)(x-4)(x+2)(x-2)<0$

-5: $(-)(-)(-)(-)<0$ ✗

-3: $(+)(-)(-)(-)<0$ ✓

3: $(+)(-)(+)(+)<0$ ✓

$-4<x\le -2$ or $2<x<4$

$(-4,-2)\cup(2,4)$

14. $x^3 + 6x^2 - 25x \le 150$

$-150\ \ -150$

$(x^3+6x^2-25x-150)=0$

$x^2\ x^2\ -25\ -25$

$x^2(x+6)-25(x+6)=0$

$(x^2-25)(x+6)=0$

$(x+5)(x-5)(x+6)=0$

$x=-5$ | $x=5$ | $x=-6$

-7: $(-)(-)(-)\le 0$ ✓

0: $(+)(-)(+)\le 0$ ✓

$x\le -6$ or $-5\le x\le 5$

$(-\infty,-6]\cup[-5,5]$

15. The nature of the roots of $-2x^2 + x = 6$ are:
1) real, rational, and equal
2) real, rational, and unequal
3) real, irrational, and unequal
4) imaginary

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

$\pm\sqrt{b^2-4ac}$

$\pm\sqrt{(1)^2-4(-2)(-6)}$

$\pm\sqrt{-47}$

16. The nature of the roots of $2x^2 = 3x + 1$ are:
1) real, rational, and equal
2) real, rational, and unequal
3) real, irrational, and unequal
4) imaginary

$2x^2-3x-1=0$

$\pm\sqrt{b^2-4ac}$

$\pm\sqrt{(-3)^2-4(2)(-1)}$

$\pm\sqrt{17}$

17. For what value of k are the roots of $-2x^2 + kx - 6 = 0$ imaginary?
1) 7 2) -7 3) 3.5 4) 9

$b^2-4ac<0$

convergent

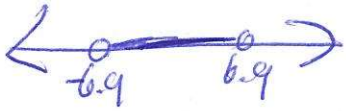
$k^2-4(-2)(-6)<0$

$k^2-48<0$

$+48 \quad +48$

$\sqrt{k^2}\leq\sqrt{48}$

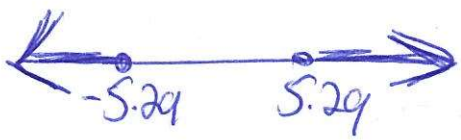
$k=\pm 6.9..$



$b^2-4ac\geq 0$

18. The roots of $x^2 + kx + 7 = 0$ are real when k is equal to:
1) 1 2) -4 3) 10 4) -5

$k^2-4(1)(7)\geq 0$ divergent



$k^2-28\geq 0$

$+28 \quad +28$

$\sqrt{k^2}\geq\sqrt{28}$

$k=\pm 5.29$

$x^2 - \text{sum}\,x + \text{product} = 0$ Sum $= \frac{-b}{a}$ Product $= \frac{c}{a}$

Find the sum and product of the roots of the following equations:

19. $x^2 - 7x = 5$

$-5 \quad -5$

$x^2 - 7x - 5 = 0$

Sum $= \frac{7}{1} = 7$

Product $= \frac{-5}{1} = -5$

20. $5x^2 + 3x = 4$

$-4 \quad -4$

$5x^2 + 3x - 4 = 0$

Sum $= \frac{-3}{5}$

Product $= \frac{-4}{5}$

Write the equation with the following roots:

21. $x = -4 \pm \sqrt{2}$

Sum $= -4 + \sqrt{2} + -4 - \sqrt{2} = -8$

Product $= (-4+\sqrt{2})(-4-\sqrt{2}) = 16 - 2 = 14$

$x^2 + 8x + 14 = 0$

22. $x = 2 \pm 4i$

Sum $= 2 + 4i + 2 - 4i = 4$

Product $= (2+4i)(2-4i) = 4 - 16i^2$

$4 + 16 = 20$

$x^2 - 4x + 20 = 0$

23. One root of $x^2 + kx + 30 = 0$ is -6. Find the other root.

Product $= \frac{c}{a}$

Product $= \frac{30}{1} = 30$

$r_1 \cdot r_2 = 30$

$-6 \cdot r_2 = 30$

$\frac{-6}{-6} \quad \frac{30}{-6}$

$r_2 = -5$

-5

Sum $= -6 + -5 = \frac{-11}{1} = \frac{-b}{a}$

$b = 11$

$k = 11$

24. One root of $x^2 - 7x + k = 0$ is 9. Find the other root.

Sum $= \frac{-b}{a}$

Sum $= \frac{7}{1} = 7$

$r_1 + r_2 = 9$

$7 + r_2 = 9$

$-7 \quad -7$

$r_2 = 2$

2

Product $= 2 \cdot 9 = \frac{18}{1} = \frac{c}{a}$

$c = 18$

$k = 18$