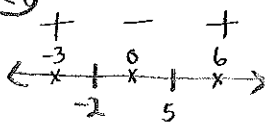


MAC1105 College Algebra Practice Problems
1.9 Polynomial and Rational Inequalities

Solve the following inequalities. Write your answer in interval notation.

1. $(x-5)(x+2) < 0$ — minus interval

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

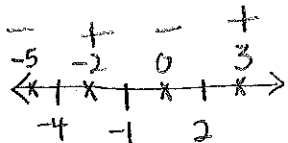


TP	$(x-5)(x+2)$	+/-
$x=-3$	$(-3-5)(-3+2) = (-8)(-1) = 8$	+
$x=0$	$(0-5)(0+2) = (-5)(2) = -10$	-
$x=6$	$(6-5)(6+2) = 1(8) = 8$	+

Solution
 $(-2, 5)$

2. $(x+1)(x-2)(x+4) > 0$ — plus intervals

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

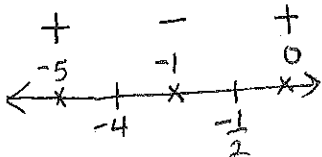


TP	$(x+1)(x-2)(x+4)$	+/-
$x=-5$	$(-5+1)(-5-2)(-5+4) = -4(-7)(-1) = -28$	-
$x=-2$	$(-2+1)(-2-2)(-2+4) = -1(-4)(2) = 8$	+
$x=0$	$(0+1)(0-2)(0+4) = 1(-2)(4) = -8$	-
$x=3$	$(3+1)(3-2)(3+4) = 4(1)(7) = 28$	+

Solution
 $(-4, -1) \cup (2, \infty)$

3. $2x^2+9x+4 < 0$ — minus intervals

$2x^2+9x+4 = 0$
 $(2x+1)(x+4) = 0$
 $2x+1=0$ $x+4=0$
 $x=-\frac{1}{2}$ $x=-4$



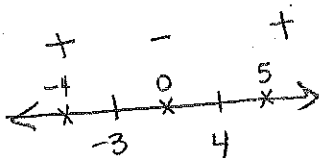
$(-4, -\frac{1}{2})$

TP	$2x^2+9x+4$	+/-
$x=-5$	$2(-5)^2+9(-5)+4 = 2(25)-45+4 = 50-45+4 = 9$	+
$x=-1$	$2(-1)^2+9(-1)+4 = 2(1)-9+4 = 2-9+4 = -3$	-
$x=0$	$2(0)^2+9(0)+4 = 0+0+4 = 4$	+

Solution
 $(-4, -\frac{1}{2})$

4. $x^2 \geq x+12 \rightarrow x^2-x-12 \geq 0$ — plus intervals & endpoints

$x^2 = x+12$
 $x^2-x-12 = 0$
 $(x-4)(x+3) = 0$
 $x-4=0$ $x+3=0$
 $x=4$ $x=-3$

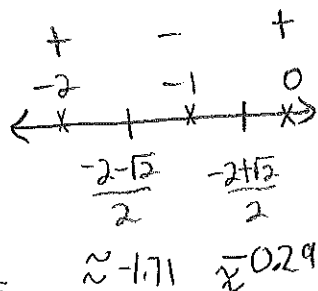


TP	x^2-x-12	+/-
$x=-4$	$(-4)^2-(-4)-12 = 16+4-12 = 20-12 = 8$	+
$x=0$	$0^2-0-12 = -12$	-
$x=5$	$5^2-5-12 = 25-5-12 = 20-12 = 8$	+

Solution
 $(-\infty, -3] \cup [4, \infty)$

5. $2x^2+4x+1 < 0$ — minus intervals

$2x^2+4x+1 = 0$
 $x = \frac{-4 \pm \sqrt{4^2 - 4(2)(1)}}{2(2)}$
 $= \frac{-4 \pm \sqrt{16-8}}{4}$
 $= \frac{-4 \pm \sqrt{8}}{4}$
 $= \frac{-4 \pm 2\sqrt{2}}{4} = \frac{-2 \pm \sqrt{2}}{2}$

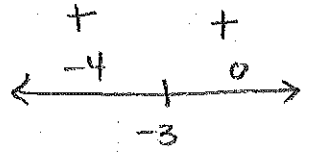


TP	$2x^2+4x+1$	+/-
$x=2$	$2(2)^2+4(2)+1 = 2(4)+8+1 = 17$	+
$x=-1$	$2(-1)^2+4(-1)+1 = 2(1)-4+1 = -1$	-
$x=0$	$2(0)^2+4(0)+1 = 0+0+1 = 1$	+

Solution
 $(\frac{-2-\sqrt{2}}{2}, \frac{-2+\sqrt{2}}{2})$

6. $x^2 + 6x + 9 \leq 0$ minus intervals and endpoints

$x^2 + 6x + 9 = 0$
 $(x+3)(x+3) = 0$
 $x+3 = 0$
 $x = -3$

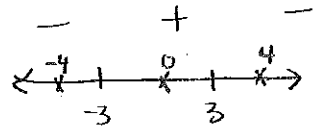


TP	$x^2 + 6x + 9$	+/-
$x = -4$	$(-4)^2 + 6(-4) + 9 = 16 - 24 + 9 = -8 + 9 = 1$	+
$x = 0$	$0^2 + 6(0) + 9 = 0 + 0 + 9 = 9$	+

Solution $\{-3\}$

7. $9 - x^2 < 0$ minus intervals

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

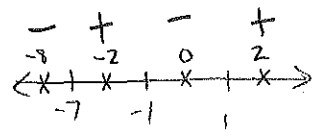


TP	$9 - x^2$	+/-
$x = -4$	$9 - (-4)^2 = 9 - 16 = -7$	-
$x = 0$	$9 - 0^2 = 9$	+
$x = 4$	$9 - 4^2 = 9 - 16 = -7$	-

Solution $(-\infty, -3) \cup (3, \infty)$

8. $x^3 + 7x^2 - x - 7 < 0$ minus intervals

$x^3 + 7x^2 - x - 7 = 0$
 $x^2(x+7) - 1(x+7) = 0$
 $(x+7)(x^2 - 1) = 0$
 $(x+7)(x+1)(x-1) = 0$
 $x+7 = 0$ $x+1 = 0$ $x-1 = 0$
 $x = -7$ $x = -1$ $x = 1$

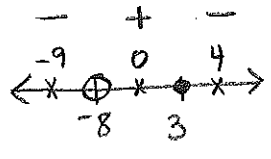


TP	$x^3 + 7x^2 - x - 7$	+/-
$x = -8$	$(-8)^3 + 7(-8)^2 - (-8) - 7 = -512 + 448 + 8 - 7 = -63$	-
$x = -2$	$(-2)^3 + 7(-2)^2 - (-2) - 7 = -8 + 28 + 2 - 7 = 15$	+
$x = 0$	$0^3 + 7(0)^2 - 0 - 7 = -7$	-
$x = 2$	$2^3 + 7(2)^2 - 2 - 7 = 8 + 28 - 2 - 7 = 27$	+

Solution $(-\infty, -7) \cup (-1, 1)$

9. $\frac{3-x}{x+8} > 0$ plus intervals

Zeros: $3-x = 0 \Rightarrow x = 3$
 Restrictions: $x+8 = 0 \Rightarrow x = -8$

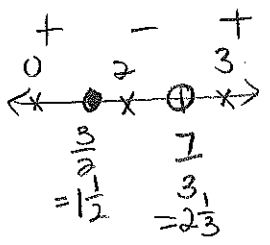


TP	$\frac{3-x}{x+8}$	+/-
$x = -9$	$\frac{3-(-9)}{-9+8} = \frac{3+9}{-1} = \frac{12}{-1} = -12$	-
$x = 0$	$\frac{3-0}{0+8} = \frac{3}{8}$	+
$x = 4$	$\frac{3-4}{4+8} = \frac{-1}{12}$	-

Solution $(-8, 3)$

10. $\frac{2x-3}{3x-7} \leq 0$ minus and endpoints

Zeros: $2x-3 = 0 \Rightarrow x = \frac{3}{2}$
 Restrictions: $3x-7 = 0 \Rightarrow x = \frac{7}{3}$



TP	$\frac{2x-3}{3x-7}$	+/-
$x = 0$	$\frac{2(0)-3}{3(0)-7} = \frac{-3}{-7} = \frac{3}{7}$	+
$x = 2$	$\frac{2(2)-3}{3(2)-7} = \frac{4-3}{6-7} = \frac{1}{-1} = -1$	-
$x = 3$	$\frac{2(3)-3}{3(3)-7} = \frac{6-3}{9-7} = \frac{3}{2}$	+

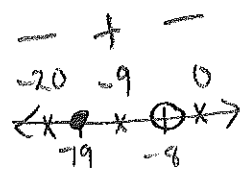
Solution $[\frac{3}{2}, \frac{7}{3})$

11. $\frac{x-3}{x+8} \leq 2$

$\frac{x-3}{x+8} - 2 \leq 0$
 $\frac{x-3-2(x+8)}{x+8} \leq 0$
 $\frac{x-3-2x-16}{x+8} \leq 0$
 $\frac{-x-19}{x+8} \leq 0$

Zeros: $-x-19 = 0 \Rightarrow x = -19$

Restrictions: $x+8 = 0 \Rightarrow x = -8$



Solution $(-\infty, -19] \cup (-8, \infty)$

TP	$\frac{-x-19}{x+8}$	+/-
$x = -20$	$\frac{-(-20)-19}{-20+8} = \frac{20-19}{-12} = \frac{1}{-12}$	-
$x = -9$	$\frac{-(-9)-19}{-9+8} = \frac{9-19}{-1} = \frac{-10}{-1} = 10$	+
$x = 0$	$\frac{-0-19}{0+8} = \frac{-19}{8}$	-