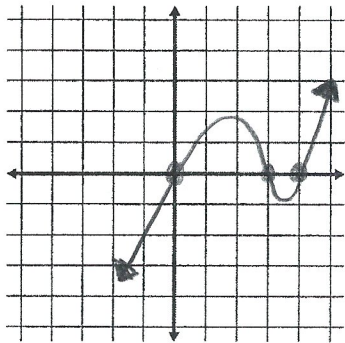


Name Answer key (1)
 Period _____

Pre-cal: Review#3.1-3.3

1. Graph $P(x) = x(x-4)(x-3)$



$$x=0$$

$$x-4=0$$

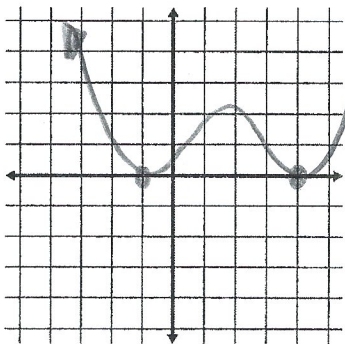
$$x-3=0$$

$$\boxed{x=0}$$

$$\boxed{x=4}$$

$$\boxed{x=3}$$

2. Graph $P(x) = (x+1)^2(x-4)^2$



Bounce Bounce

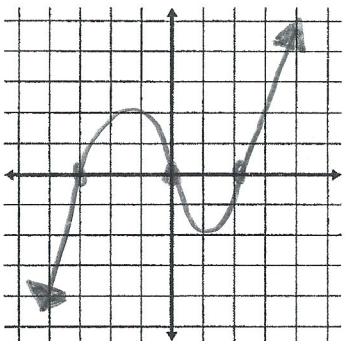
$$x+1=0$$

$$\boxed{x=-1}$$

$$x-4=0$$

$$\boxed{x=4}$$

3. Graph $P(x) = x^3 + x^2 - 6x$



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

$$\begin{array}{r} -6 \\ 3 \times -2 \\ \hline 1 \end{array}$$

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

$$\boxed{x=0}$$

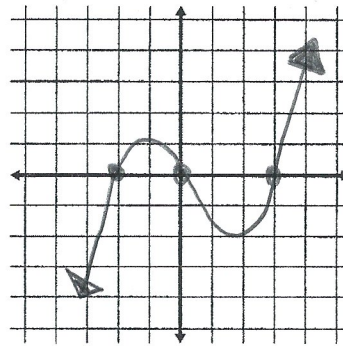
$$x+3=0$$

$$x-2=0$$

$$\boxed{x=-3}$$

$$\boxed{x=2}$$

4. Graph: $P(x) = x^3 - x^2 - 6x$



$$x(x^2-x-6)$$

$$\begin{array}{r} -6 \\ -3 \times 2 \\ \hline -1 \end{array}$$

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

$$\boxed{x=0}$$

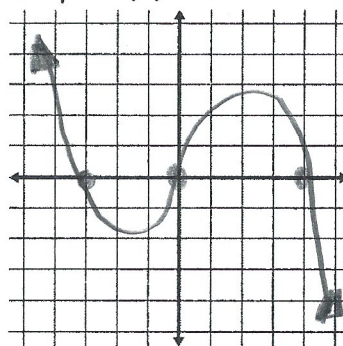
$$x-3=0$$

$$x+2=0$$

$$\boxed{x=3}$$

$$\boxed{x=-2}$$

5. Graph: $P(x) = -x^3 + x^2 + 12x$



$$-x(x^2-x-12)$$

$$\begin{array}{r} -12 \\ -4 \times 3 \\ \hline -1 \end{array}$$

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

$$-x=0$$

$$x-4=0$$

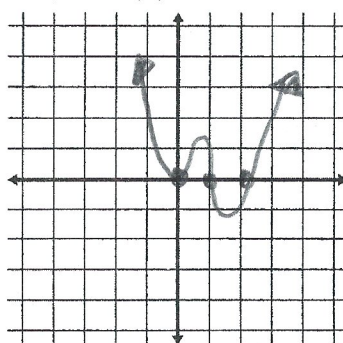
$$x+3=0$$

$$\boxed{x=0}$$

$$\boxed{x=4}$$

$$\boxed{x=-3}$$

6. Graph: $P(x) = x^4 - 3x^3 + 2x^2$



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

$$\begin{array}{r} 2 \\ -2 \times -1 \\ \hline -3 \end{array}$$

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

$$x^2=0$$

$$x-2=0$$

$$x-1=0$$

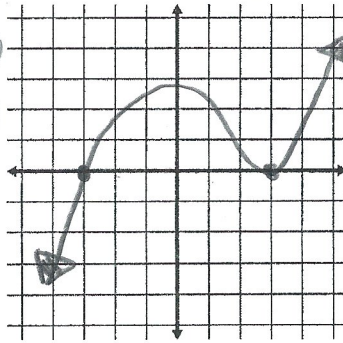
$$\boxed{x=0}$$

$$\boxed{x=2}$$

$$\boxed{x=1}$$

Bounce

7. Graph: $P(x) = \frac{x^2}{x-3} - \frac{9}{x-3} + 27$



$$(x^2-9)(x-3)$$

$$\downarrow$$

$$(x+3)(x-3)(x-3)$$

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

$$x+3=0$$

$$x-3=0$$

$$\boxed{x=-3}$$

$$\boxed{x=3}$$

Bounce

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

$$\begin{array}{r} x^2 - 1 \\ 2x - 3 \overline{) 2x^3 - 3x^2 - 2x + 0} \\ \underline{-2x^3 + 3x^2} \\ -2x + 0 \\ \underline{+2x - 3} \\ -3 \end{array}$$

8. Divide using long division. $\frac{2x^3 - 3x^2 - 2x}{2x - 3}$

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

9. Divide using long division. $\frac{x^3 + 3x^2 + 4x + 3}{3x + 6}$

$$\frac{2x}{3x} = \frac{2}{3} \quad \frac{x^2}{3x} = \frac{1}{3}x \quad \frac{x^3}{3x} = \frac{1}{3}x^2$$

$$\begin{array}{r} \frac{1}{3}x^2 + \frac{1}{3}x + \frac{2}{3} \\ 3x + 6 \overline{) x^3 + 3x^2 + 4x + 3} \\ \underline{-x^3 + 2x^2} \\ x^2 + 4x + 3 \\ \underline{-x^2 + 2x} \\ 2x + 3 \\ \underline{-2x - 4} \\ -1 \end{array}$$

$$\boxed{\frac{1}{3}x^2 + \frac{1}{3}x + \frac{2}{3} + \frac{-1}{3x + 6}}$$

10. Divide using long division. $\frac{4x^3 + 2x^2 - 2x - 3}{2x + 1}$

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

$$\begin{array}{r} 2x^2 - 1 \\ 2x + 1 \overline{) 4x^3 + 2x^2 - 2x - 3} \\ \underline{-4x^3 + 2x^2} \\ -2x - 3 \\ \underline{+2x + 1} \\ -2 \end{array}$$

$$\boxed{2x^2 - 1 + \frac{-2}{2x + 1}}$$

11. Divide using synthetic division. $\frac{3x^2 + 5x}{x - 6}$

$$\begin{array}{r|rrrr} 6 & 3 & 5 & 0 & -2 \\ & & 18 & 138 & \\ \hline & 3x & 23 & 138 & \end{array}$$

$$\boxed{3x + 23 + \frac{138}{x - 6}}$$

12. Divide using synthetic division. $\frac{x^3 + 2x^2 + 2x + 1}{x + 2}$

$$\begin{array}{r|rrrrr} -2 & 1 & 2 & 2 & 1 \\ & & -2 & 0 & -4 \\ \hline & 1x^2 & 0x & 2 & -3 \end{array}$$

$$\boxed{x^2 + 2 + \frac{-3}{x + 2}}$$

13. Evaluate: $f(x) = -x^3 + 6x - 7$; $x = 2$

plug in $f(2) = -(2)^3 + 6(2) - 7$
 $= -8 + 12 - 7 = \boxed{-3}$

14. Evaluate: $f(x) = x^3 + 3x^2 + 2x + 8$; $x = -3$

plug in $f(-3) = (-3)^3 + 3(-3)^2 + 2(-3) + 8$
 $= -27 + 27 - 6 + 8 = \boxed{2}$

15. Find all possible rational zeros.

$$P(x) = x^3 - 4x^2 - 7x + 10$$

attached (1)

16. Find all possible rational zeros:

$$f(x) = x^3 - 13x^2 + 23x - 11$$

attached (1)

$$(15) \quad p(x) = x^3 - 4x^2 - 7x + 10$$

$$p = 10 \quad \text{Factors: } \pm 1, \pm 2, \pm 5, \pm 10$$

$$q = 1 \quad \text{Factors: } \pm 1$$

$$\frac{p}{q} = \pm 1, \pm 2, \pm 5, \pm 10$$

ZEROS: 1, 2, 5

$$\begin{array}{r|rrrr} 1 & 1 & -4 & -7 & 10 \\ & & 1 & -3 & -10 \\ \hline \end{array}$$

$$x^2 - 3x - 10 \quad 0 \quad \text{!!}$$

$$\begin{array}{r} -10 \\ \times \\ -5 \quad 2 \\ \hline -3 \end{array}$$

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

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

$$x=5, \quad x=2$$

$$(10) \quad p(x) = x^3 - 13x^2 + 23x - 11$$

$$p = -11 \quad \text{Factors: } \pm 1, \pm 11$$

$$q = 1 \quad \text{Factors: } \pm 1$$

$$\frac{p}{q} = \pm 1, \pm 11$$

1

$$\begin{array}{r} 1 \quad -13 \quad 23 \quad -11 \\ \quad 1 \quad -12 \quad 11 \end{array}$$

$$1x^2 - 12x + 11 \quad 0 \quad (11)$$

$$x^2 - 12x + 11 = 0$$

$$\begin{array}{r} 11 \\ -11 \quad -1 \\ -12 \end{array}$$

$$(x-11)(x-1) = 0$$

$$x-11=0 \quad x-1=0$$

$$x=11 \quad x=1$$

^{Roots}
ZEROS: 1, 11