1. –5, 1, and 2

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

$(x^2 + 4x - 5)(x - 2) = 0$

$\cancel{x^3} - \cancel{2x^2} + \cancel{4x^2} - \cancel{8x} - \cancel{5x} + 10$

$x^3 + 2x^2 - 13x + 10$

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2. –3, –1, and 0

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

$x(x^2 + 4x + 3)$

$x^3 + 4x^2 + 3x$

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3. 1, 4, and 5

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4. –2, 3, and 6

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Find the roots of the equation $x^4 - 3x^3 + 6x^2 - 12x + 8 = 0$. $\frac{\pm 1, 2, 4, 8}{\pm 1}$

7. Possible roots: ±1, ±2, ±4, ±8

Test: $(x-1)$ and $(x-2)$.

1 and 2 are real roots.

Solve $x^2 - 3x + 2$ to find the remaining roots.

Remaining roots: $2i$ and $-2i$.

$$\begin{array}{r} \boxed{x^2 + 0x + 4} \\ x^2 - 3x + 2 \,\overline{)\, x^4 - 3x^3 + 6x^2 - 12x + 8} \\ \underline{\cancel{x^4} - \cancel{3x^3} + 2x^2} \\ 4x^2 - 12x + 8 \\ \underline{4x^2 - 12x + 8} \\ 0 \end{array}$$

$x^2 + 4 = 0$

$\sqrt{x^2} = \sqrt{4}$

$x = \pm 2i$

$$\begin{array}{r|rrrrr} 1 & 1 & -3 & 6 & -12 & 8 \\ & & 1 & -2 & 4 & -8 \\ \hline & 1 & -2 & 4 & -8 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & -2 & 4 & -8 \\ & & 2 & 0 & 8 \\ \hline & 1 & 0 & 4 & 0 \end{array}$$

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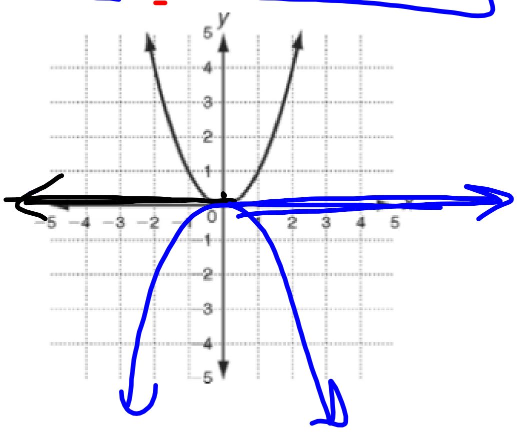
Even

Positive leading coefficient

As $x \to -\infty$, $P(x) \to +\infty$.

As $x \to +\infty$, $P(x) \to +\infty$.



$-2x^{24}$

$3x^{12}$

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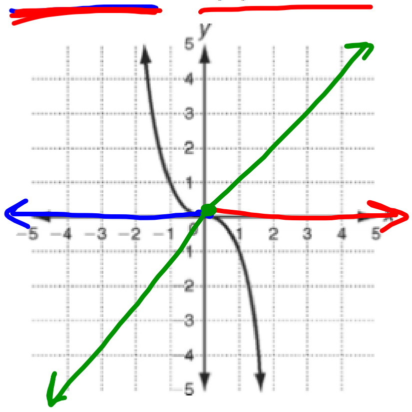
odd

$\boxed{y = x^1}$

Negative leading coefficient

As $x \to -\infty$, $P(x) \to +\infty$.

As $x \to +\infty$, $P(x) \to -\infty$.



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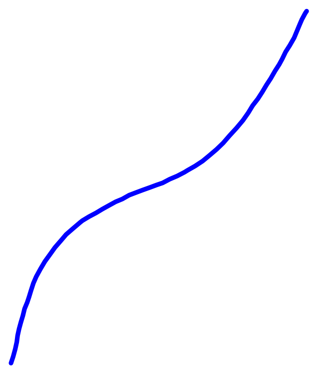
1. $P(x) = 4x^3 + 8x^2 - 5$

Leading term: $4x^3$

Sign and degree: + ; 3 odd

End behavior: $x \to -\infty$ $P(x) \to -\infty$

$x \to \infty$ $P(x) \to \infty$



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2. $P(x) = -9x^6 + 2x^3 - x + 7$

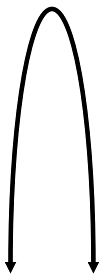
Leading term: $-9x^6$

Sign and degree: neg ; 6 even

End behavior: $x \to -\infty$ $P(x) \to -\infty$

$x \to \infty$ $P(x) \to -\infty$

$-\infty$



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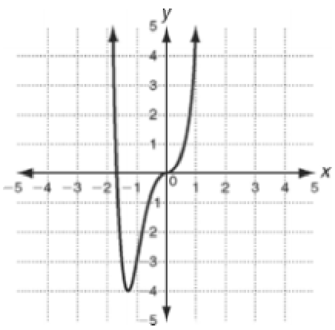
3.



even

(+) leading coef.

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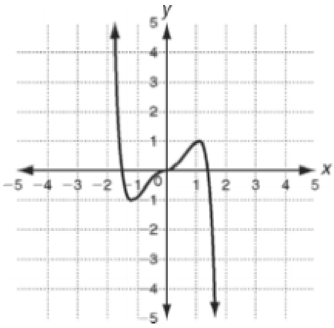
4.



$y = x$

odd

(-) leading coeff.

$x = 0$

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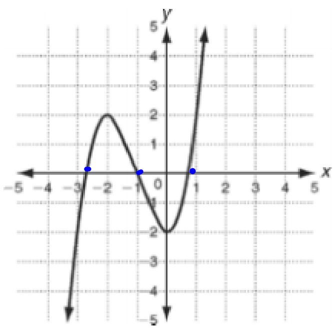
5.



odd

(+)

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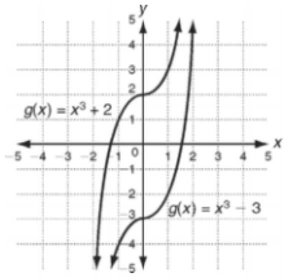
Vertical Translation	
If $f(x)$ is a polynomial function, $g(x) = f(x) + k$ is a vertical translation of $f(x)$. *Example:* $f(x) = x^3 + 2$	Think: Add to y, go high. $f(x)$ shifts up for $k > 0$. $f(x)$ shifts down for $k < 0$.
Vertical translation 5 units down $g(x) = f(x) - 5$ $g(x) = x^3 + 2 - 5$ $g(x) = x^3 - 3$	

To graph $g(x)$, move the graph of $f(x)$ 5 units down.

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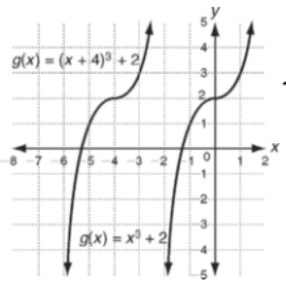
Horizontal Translation	
If $f(x)$ is a polynomial function, $g(x) = f(x - h)$ is a horizontal translation of $f(x)$. *Example:* $f(x) = x^3 + 2$	Think: Add to x, go west. $f(x)$ shifts right for $h > 0$. $f(x)$ shifts left for $h < 0$.
Horizontal translation 4 units left $g(x) = f\left(x - (-4)\right)$ $g(x) = (x + 4)^3 + 2$	

To graph $g(x)$, mov the graph of $f(x)$ 4 units left.

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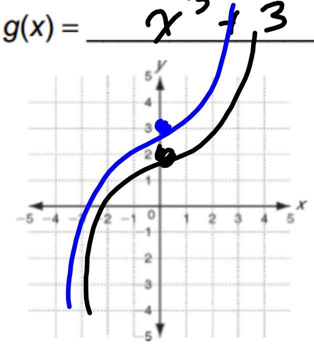
For $f(x) = x^3 + 2$, write the rule for each function and sketch its graph.

1. $g(x) = f(x) + 1$ x^3+2 $+1$

   Translate $f(x)$ 1 unit ___up___.

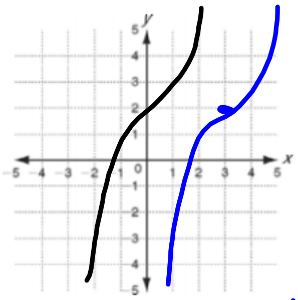
   $g(x) =$ ___x^3+3___



2. $\boxed{g(x) = f(x - 3)}$

   Translate $f(x)$ 3 units ___Right___.

   $g(x) =$ ___$(x-3)^3+2$___



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

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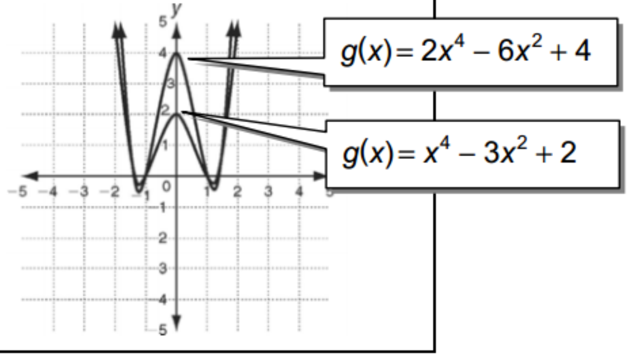
Vertical Stretch or Compression	
If $f(x)$ is a polynomial function, $g(x) = af(x)$ is a vertical stretch or compression of $f(x)$. *Example*: $f(x) = 2x^4 - 6x^2 + 4$	Vertical stretch if $a > 1$ Vertical compression if $0 < a < 1$
Vertical compression of $f(x)$ $g(x) = \frac{1}{2}f(x)$ $g(x) = \frac{1}{2}(2x^4 - 6x^2 + 4)$ $g(x) = x^4 - 3x^2 + 2$	

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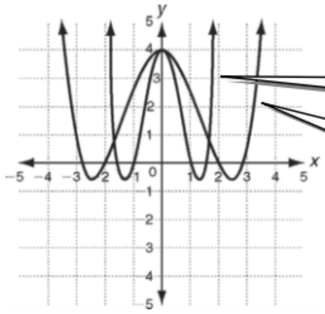
Horizontal Stretch or Compression	
If $f(x)$ is a polynomial function, $\boxed{g(x) = f\left(\frac{1}{b}x\right)}$ is a horizontal stretch or compression of $f(x)$. *Example:* $f(x) = 2x^4 - 6x^2 + 4$	Horizontal stretch if $b > 1$ Horizontal compression if $0 < b < 1$
Horizontal stretch of $f(x)$ $g(x) = f\left(\frac{1}{2}x\right)$ $g(x) = 2\left(\frac{1}{2}x\right)^4 - 6\left(\frac{1}{2}x\right)^2 + 4$ $g(x) = \frac{1}{8}x^4 - \frac{3}{2}x^2 + 4$	

$g(x) = 2x^4 - 6x^2 + 4$

$g(x) = \frac{1}{8}x^4 - \frac{3}{2}x^2 + 4$

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Let $f(x) = 2x^4 - 6x^2 + 4$. Describe $g(x)$ as a transformation of $f(x)$ and write the rule for $g(x)$.

3. $g(x) = 2f(x)$

____

____

4. $g(x) = f(2x)$

____

____

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Use finite differences to determine the degree of the polynomial that best describes the data.

1.

x	–2	–1	0	1	2
y	–5	2	3	4	11
First Differences	+7 +1 +1 +7				
Second Differences	-6 +0 +6				
Third Differences	+6 +6				

2. Identify the degree of the polynomial. cubic

Nov 7-8:20 AM

Write a polynomial function for the data.

3.

x	2	4	6	8	10	12
y	–12	–15	38	190	446	773
First Differences	-3 +53 +152 +256 +327					
Second Differences	+56 +99 +104 +71					
Third Differences	43 +5 -33					
Fourth Differences	-38 -38					

4. Write a polynomial function that best describes the data set.

Quartic

Nov 7-8:20 AM