

Name KEY

For each polynomial function:

- Find the end behavior
- List all possible rational roots
- Find all real zeros
- Find the y-intercept
- Write as a product of linear (quadratic if not real) factors
- Graph. Use your calculator to help you find rational zeros. Use synthetic division to find at least one point between each of the x-intercepts

✓ 1.  $f(x) = -2x^3 + 9x^2 + 5x$

$$= x(2x^2 - 9x - 5)$$

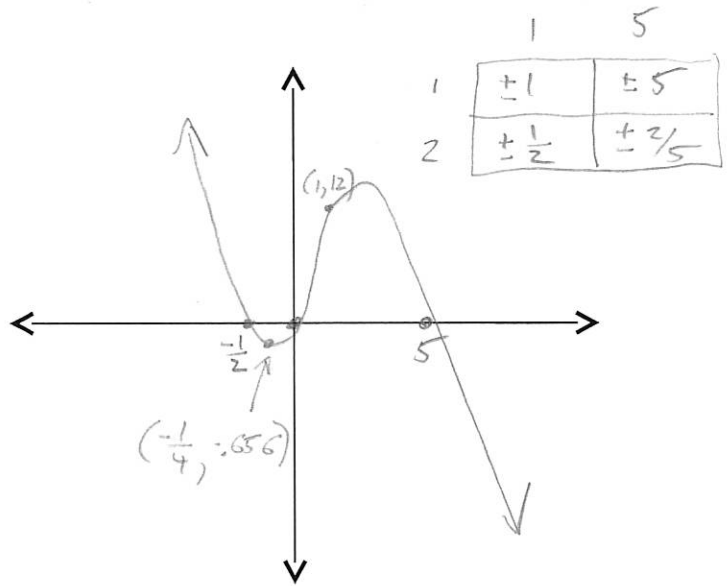
$$= -x(2x + 1)(x - 5)$$

left end:  $+\infty$  right end:  $-\infty$

zeros:  $0, -\frac{1}{2}, 5$   
y-int:  $0$

$$f(-\frac{1}{4}) = -.6525$$

$$f(1) = 12$$



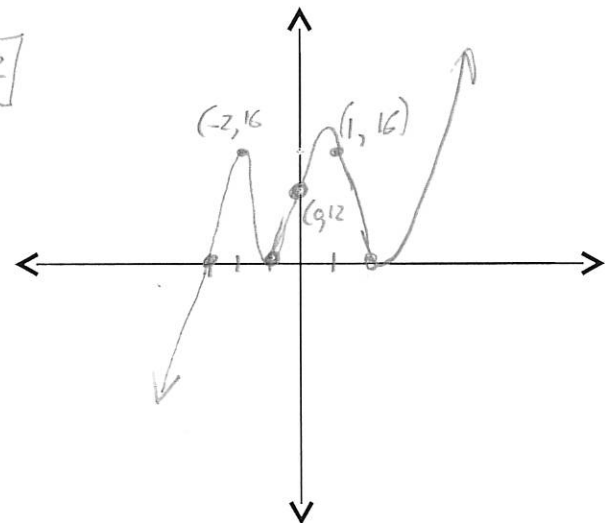
✓ 2.  $f(x) = x^5 + x^4 - 9x^3 - 5x^2 + 16x + 12$

left:  $-\infty$  right:  $\infty$  y-int:  $12$

	1	2	3	4	6	12
$\pm 1$	$\pm 1$	$\pm 2$	$\pm 3$	$\pm 4$	$\pm 6$	$\pm 12$

zeros:  $-3, -1, 2$

-3	1	1	-9	-5	16	12
	0	-3	6	9	-12	-12
-1	1	-2	-3	4	4	0
	0	-1	3	0	-4	
2	1	-3	0	4	0	
	0	2	-2	-4		
	1	-1	-2	0		



$$f(-2) = 16$$

$$f(1) = 16$$

$$y = (x+3)(x+1)(x-2)(x^2-x-2)$$

$$y = (x+3)(x+1)(x-2)(x+1)(x-2)$$

$$y = (x+1)^2(x-2)^2(x+3)$$

$$\sqrt{3. f(x) = -x^4 + 12x^2 - 27}$$

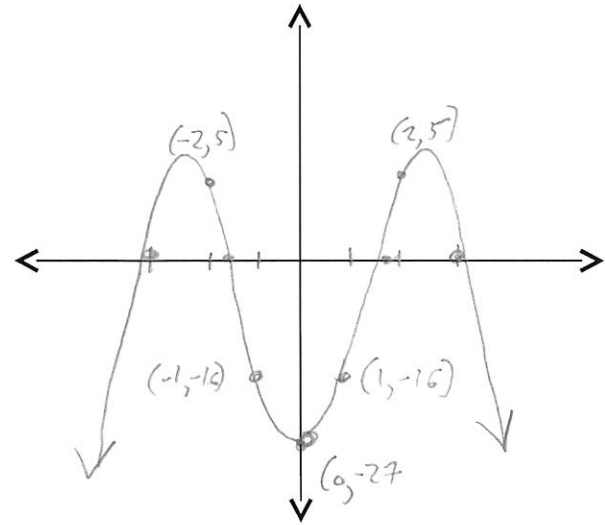
$$= -(x^4 - 12x^2 + 27)$$

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

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

left  $-\infty$  right  $-\infty$

1	3	9	27	
1	$\pm 1$	$\pm 3$	$\pm 9$	$\pm 27$



Zeros  $(\pm 3, 0)$   $(\pm \sqrt{3}, 0)$

y-int  $(0, -27)$

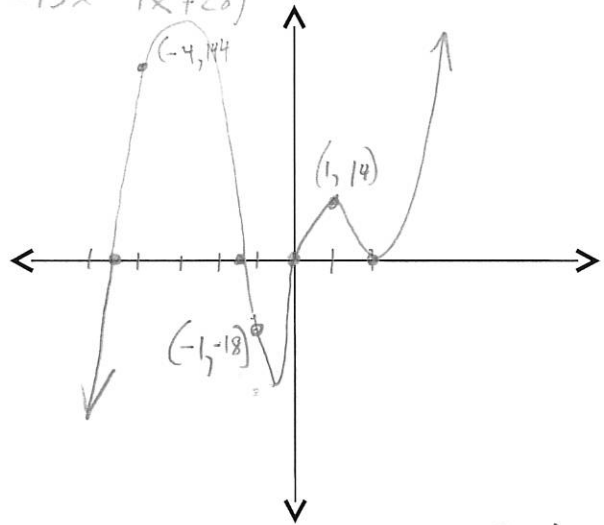
$$f(-2) = 5 \quad f(1) = -16$$

$$f(2) = 5 \quad f(-1) = -16$$

$$\sqrt{4. f(x) = x^5 + 2x^4 - 13x^3 - 4x^2 + 28x} \quad x(x^4 + 2x^3 - 13x^2 - 4x + 28)$$

left  $-\infty$  right  $\infty$

1	2	4	7	14	28	
1	$\pm 1$	$\pm 2$	$\pm 4$	$\pm 7$	$\pm 14$	$\pm 28$



Zeros  $0, 2, -3 \pm \sqrt{2} \approx -1.5, -4.4$

2	1	2	-13	-4	28
0	2	8	-10	28	

y-int  $(0, 0)$

2	1	4	-5	-14	0
0	2	12	14		

1	6	7	0
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$$f(-4) = 144$$

$$f(-1) = -18$$

$$f(1) = 14$$

$$y = x(x-2)^2(x^2+6x+7) \rightarrow$$

$$x = \frac{-6 \pm \sqrt{36 - 4(1)(7)}}{2}$$

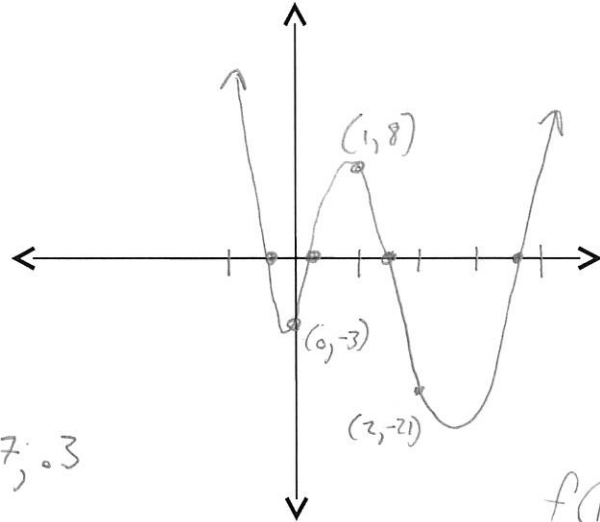
$$x = \frac{-6 \pm \sqrt{8}}{2} = \frac{-6 \pm 2\sqrt{2}}{2} = -3 \pm \sqrt{2}$$

√ 5.  $f(x) = 6x^4 - 31x^3 + 31x^2 + 5x - 3$

left ∞ right ∞

	1	3
1	±1	±3
2	±1/2	±3/2
3	±1/3	X
6	±1/6	X

Zeros  $\frac{3}{2}, -\frac{1}{3}, 2 \pm \sqrt{3} \approx 3.7, .3$



$f(1) = 8$   
 $f(2) = -21$

$\frac{3}{2}$	6	-31	31	5	-3
	0	9	-33	-3	-3
$-\frac{1}{3}$	6	-22	-2	2	0
	0	-2	8	-2	
	6	-24	6	0	

y-int (0, -3)

$y = (x - \frac{3}{2})(x + \frac{1}{3}) \cdot 6(x^2 - 4x + 1)$

$y = (2x - 3)(3x + 1)(x^2 - 4x + 1)$

$x = \frac{4 \pm \sqrt{16 - 4(1)(1)}}{2}$   
 $= \frac{4 \pm \sqrt{12}}{2} = \frac{4 \pm 2\sqrt{3}}{2}$   
 $= 2 \pm \sqrt{3}$

√ 6.  $f(x) = x^5 - 3x^4 - x^3 + 3x^2 - 2x + 6$

left -∞ right ∞

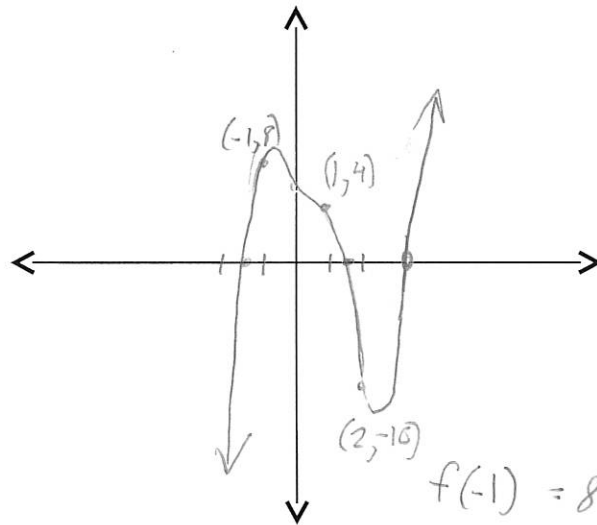
	1	2	3	6
1	±1	±2	±3	±6

Zeros 3, ±√2 ≈ 1.4, -1.4

3	1	-3	-1	3	-2	6
	0	3	0	-3	0	-6
	1	0	-1	0	-2	0

$y = (x - 3)(x^4 - x^2 - 2)$

$y = (x - 3)(x^2 + 1)(x^2 - 2)$



$f(-1) = 8$   
 $f(1) = 4$   
 $f(2) = -10$

y-int (0, 6)