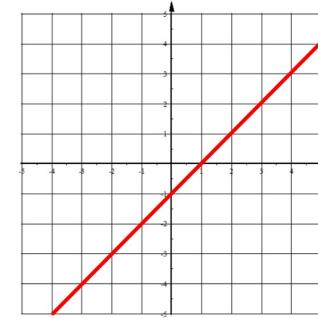Given the equation $y = (x + 3)(x - 2)$

Give four names for -3 and 2:

- Zeros of the function
- Solutions to the equation
- x-intercepts of the graph
- Roots of the function

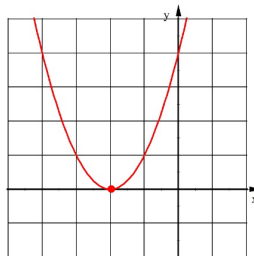What does the graph
of this look like?

$y = x - 1$

Just a line
that passes right
through the x-axis

What does the graph
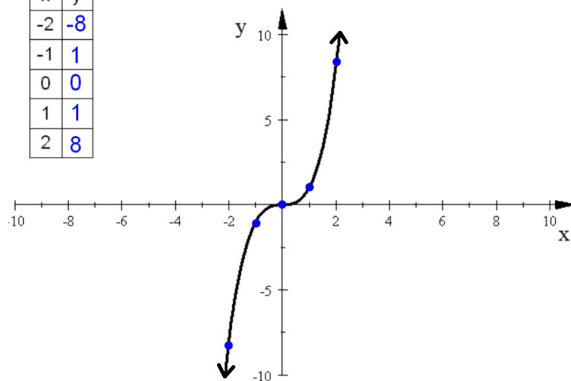of this look like?

$y = (x + 2)^2$

A parabola
whose vertex is
on the x-axis

What does the graph of $y = x^3$ look like?

It has an ODD degree and a Positive leading
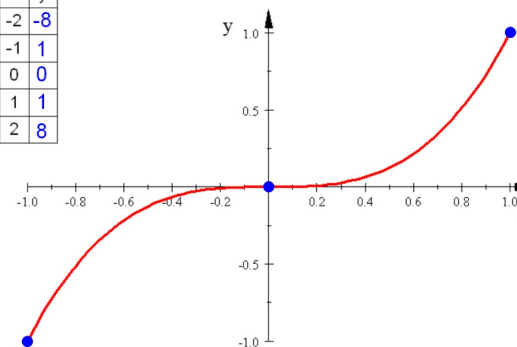coefficeint so the end behavior is just like
a line.

Slide 1

x	y
-2	-8
-1	1
0	0
1	1
2	8

This is the graph of $y = x^3$

Same end behavior as a line but it's slightly different in the middle.

Slide 2

A closer look at $y = x^3$

x	y
-2	-8
-1	1
0	0
1	1
2	8

This graph passes through the x-axis like a line does but flattens out as it passes through the x-axis.

Slide 3

Shapes of Zeros Exploration

You will be graphing polynomials using the graphing calculator and sketching what you see in the window and answering questions about what the graph looks like at a given spot.

What does it mean when the directions state the following:

Use the following window: x:[1,3] & y:[-2,2]

x_{min} x_{max} y_{min} y_{max}

Slide 4

1. Graph $y = (x-1)(x+2)^2$ in a Standard Window and sketch it below:
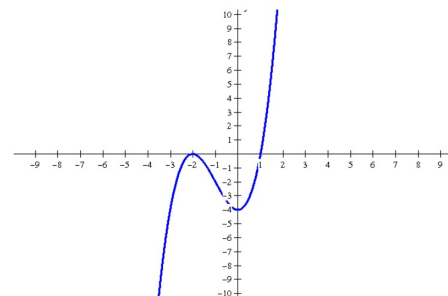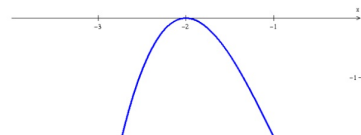
2. Investigate the graph around each zero

Around -2: Use the following window: $x : [-4,0]$ & $y : [-2,2]$

Sketch the graph below:

-2 is from this factor

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

-2 is a double zero. (double zero because the exponent on the factor is 2)

Double zeros look like Parabolas.

Describe what the graph looks like in this window.

a parabola whose vertex is on the x-axis.

Around 1: Use the following window: $x : [0,2]$ & $y : [-2,2]$

Sketch the graph below: 1 comes from this factor

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

1 is a single zero. (single zero because the exponent on the factor is 1)

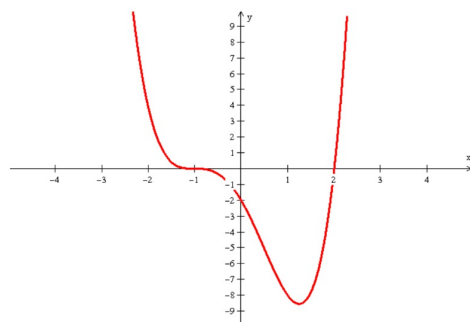Single Zeros look like a line passing through the x-axis.

Describe what the graph looks like in this window.

A line that passes right through the x-axis

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3. Graph $y = (x+1)^3(x-2)$ in the following window and sketch it below:

Window: $x : [-5,5]$ & $y : [-10,10]$

Around -1: Use the following window: $x : [-2,0]$ & $y : [-2,2]$
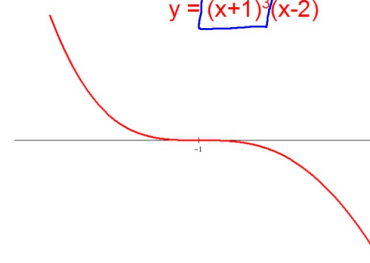
Sketch the graph below: -1 comes from this factor

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

-1 is a triple zero (triple zero because the exponent on the factor is 3)

Triple Zeros look like: they pass through the x-axis but flatten out as they pass through.
Look like a cubic function

Describe what the graph looks like in this window.

A cubic, the graph flattens out as it passes through the x-axis

Panel 1 (top-left)

Around **2**: Use the following window: $x : [1,3]$ & $y : [-2,2]$

Sketch the graph below:
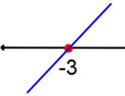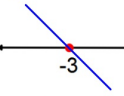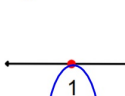
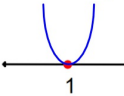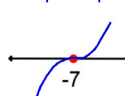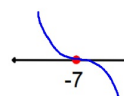$y = (x+1)^3(x-2)$ → 2 comes from this factor

2 is a single zero. (single zero because the exponent on the factor is 1)

Single Zeros look like a line passing through the x-axis.

Describe what the graph looks like in this window.

a line that passes right through the x-axis

Panel 2 (top-right)

Shapes of Zeros (graphs at x-intercepts)

Factor	Zero	Possible Shape

Single Zeros: $(x+3)$ — -3 or -3

Double Zeros: $(x-1)^2$ — 1 or 1

Triple Zeros: $(x+7)^3$ — -7 or -7

Panel 3 (bottom-left)

Sketch a graph of this function:

$y = (x+2)^2(x-5)^3(x+7)$

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

1. Find the Degree and LC
   EVEN POS
2. Determine End Behavior
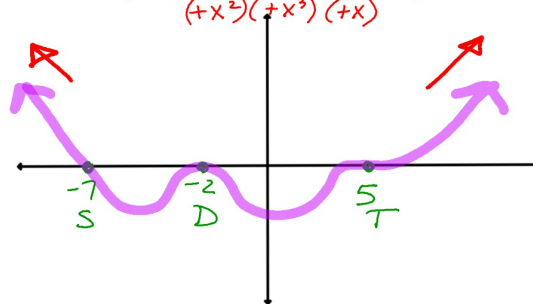 $(\uparrow , \nearrow)$
3. Find zeros and what kind
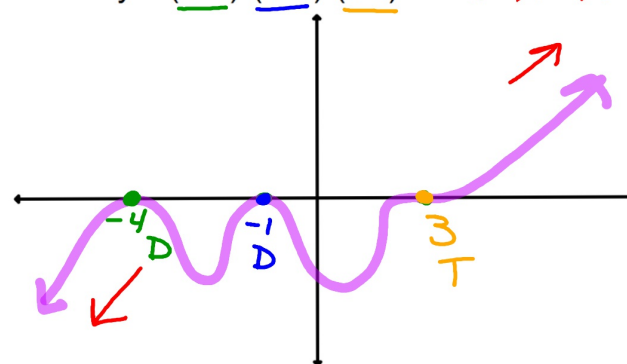   −2 DOUBLE
   5 TRIPLE −7 single
4. Place dots on the x-axis for the zeros.
5. Connect Left End to Right End making sure the shape of each zero is correct.

−7 S   −2 D   5 T

Panel 4 (bottom-right)

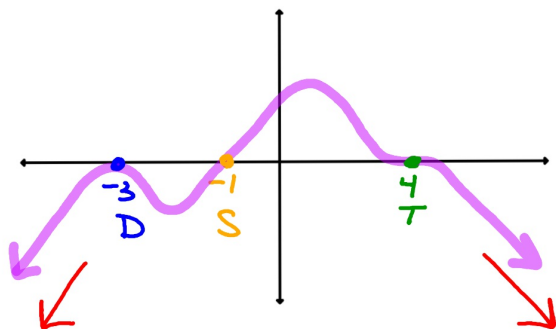**Sketch this function using the shapes of the zeros and the end-behavior**

$y = (x+4)^2(x+1)^2(x-3)^3 = (+x^2)(+x^2)(+x^3) \Rightarrow$ POS ODD

$(\swarrow , \nearrow)$

−4 D   −1 D   3 T

Sketch this function using the shapes of the
zeros and the end behavior.

$y = (4 - x)^3(x + 3)^2(x + 1) = (-x^3)(+x^2)(+x) \Rightarrow$ NEG EVEN $(\swarrow, \searrow)$

Sketch a graph of this function:

$y = -x^3(x - 6)(x + 4)^2(x - 9) = (-x^3)(+x)(+x^2)(+x) =$ ODD NEG $(\nwarrow, \searrow)$