

Consider the following functions:

(1. through 2. **Write ALL asymptotes as  $x=$  or  $y=$  lines where applicable** )

1) Using the following function:  $f(x) = \frac{3x-1}{x^3-x}$

i) State the domain: \_\_\_\_\_(3)

ii) What are the vertical asymptote(s) - if they exist \_\_\_\_\_(2)

iii) Identify and find the end behavior asymptote -- use answer area below:

End Behavior Asymptote:

**Type:** (Circle Below) (2 pts)

horizontal   oblique   other

and find it.----->

Asymptote:\_\_\_\_\_ (4)

2) Using the following function:  $G(x) = \frac{x^2 + 6x + 9}{x + 1}$

i) State the domain: \_\_\_\_\_ (3)

ii) What are the vertical asymptote(s) - if they exist \_\_\_\_\_ (2)

iii) Identify and find the end behavior asymptote -- use answer area below:

End Behavior Asymptote:

**Type:** Circle Below

horizontal oblique other (2)

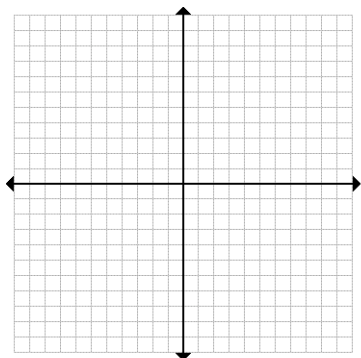
and find it.----->

Asymptote: \_\_\_\_\_ (3)

iv) Find the x-intercept(s) of **G(x)** iv. \_\_\_\_\_ (3)  
**(Write your answer(s) as an (x,y) coordinate point(s).)**

v) Find the y-intercept of **G(x)** v. \_\_\_\_\_ (3)

iv) Sketch **G(x)** Carefully label the intercepts and asymptotes. 5 points  
**You may need to scale your graph paper to get a complete graph.**



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3. Solve **algebraically** - **show all work**. You cannot use your grapher to solve these problems. All Algebraic work is necessary to get full credit.

a.  $x^4 - 16x^3 - 17x^2 < 0$  a. \_\_\_\_\_(6)

b.  $\frac{x^2 - x - 6}{x^3 - x} \geq 0$  b. \_\_\_\_\_(6)

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4. Given the following function:  $P(X) = 2x^4 + 5x^3 + 5x^2 + 20x - 12$

a) List all the rational possibilities for roots of P(x):      Circle Your Answers ( 4 points)

b) Use your grapher to narrow the possibilities from the above list and list only those that make sense.

\_\_\_\_\_ (3)

c) Use b) above to help you find all the complex zeros: \_\_\_\_\_ (4)

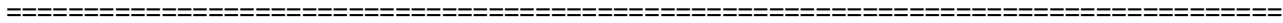
c) Use the above information to factor P(x) and write in **factored** form.  
(4 points) NOTE: The highest power of each factor should be 1.

Factored form:  $P(x) =$  \_\_\_\_\_

5. Find an 8th degree polynomial with the following roots:  
**(DO NOT multiply it out)** 0 of multiplicity 3,  $-2$ ,  $7i$ ,  $1 - \sqrt{2}$

**ANSWER TO #5 BELOW (4 POINTS)**

$P(x) =$  \_\_\_\_\_



6. Given the following function:  $f(x) = -\frac{1}{2}x^3(x-1)(x+2)^2$

a) Determine whether the graph of  $f$  crosses or touches the  $x$ -axis at each  $x$ -intercept. (6 points)

zeros:			
Multiplicity of the zero:			
Touch/Cross:			
Shape at that zero:			

b) Power Function: \_\_\_\_\_(2)

c) End Behavior: (circle one)

top/top    bottom/bottom    bottom/top    top/bottom    (2 points)

d) Maximum Number of Turning Points: \_\_\_\_\_(1)

7. Given the graph below:

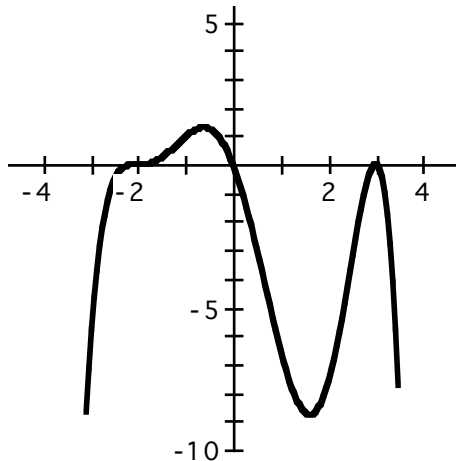
a. List the roots and state the multiplicity of each zero

<b>Zero:</b>	<b>Multiplicity:</b> (6)
_____	_____
_____	_____
_____	_____

b. What is the possible degree of this function: **degree:** \_\_\_\_\_(2)

c. Write a “**possible**” function that would represent the graph of the function below. Leave your answer in factored form. (**DO NOT TRY TO MULTIPLY OUT**)

Possible Function:  $f(x) =$  \_\_\_\_\_ (4)



8. The following data shows how Social Security assets are expected to change as the number of retirees receiving benefits increase. Where  $x$  represents **the number of years beyond the year 2000** (Source: Social Security Administration.)

a) Align your data: (2 points)		
State your values of $X$	Year	Assets (In Billions) $Y$
	2010	\$2400
	2015	3200
	2020	3900
	2025	3100

- b) Find a **Cubic Function** which BEST fits the above data.  
**Round your answer to the nearest hundredth (2 decimal places)**
- $y =$  \_\_\_\_\_ (4)
- b) What would the assets be for the year 2007? Assets: \_\_\_\_\_ (3)
- c) What is **the average rate of change** between the years 2010 and 2020? \_\_\_\_\_ (3)  
 Be sure to include your units.
- d) Interpret the number you got in c) above in terms of years and assets. (2)
- e) Predict the amount of assets in the year 2040? \_\_\_\_\_ (3)
- f) How do you interpret the number you got in part e).? What does that tell us about Social Security assets if our model is correct? (2)