Chapter 15 review

Name: ____________

$$Given: f(x) = \frac{x^3 - x^2 - 7x + 15}{x + 3}$$

a) b)
1. What does this graph have? Where is it?

a) Discontinuity b) @ $x = -3$

a) b) c)
2. What kind? How do you know? What is the limit?

a) removable ; b) x+3 is a factor of the numerator

c) $\lim_{x \to -3} f(x) = 26$

$$\begin{array}{r|rrrr} -3 & 1 & -1 & -7 & 15 \\ & \downarrow & -3 & 12 & -15 \\ \hline & 1 & -4 & 5 & \boxed{0} \end{array}$$

$x^2 - 4x + 5 \rightarrow (-3)^2 - 4(-3) + 5$

$9 + 12 + 5$

3. Write the numerator as a product of a linear factor and a quadratic.

$$\frac{(x+3)(x^2-4x+5)}{(x+3)}$$

a) b)
4. Simplify. How could you graph this without a calculator? $\boxed{\text{* don't forget the hole @ } x = -3}$

a) cancel out the (x+3)'s $\Rightarrow x^2 - 4x + 5$

b) graph what's left $\rightarrow x^2 - 4x + 5$ (make x/y chart, etc.)

x	y
0	5
1	2
	etc.

* find vertex

$x = -\frac{b}{2a} = \frac{4}{2} = 2$

$y = 2^2 - 4(2) + 5$

$y = 1$

(2,1)

a.) b) c)
5. What kind of zeros are remaining? How do you know? How can you find them?

$x^2 - 4x + 5 \rightarrow$ b.) graph; doesn't touch x axis / neg. # under $\sqrt{\ }$ } a.) imaginary

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c.) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ or calc if it's on that part of test

$$x = \frac{4 \pm \sqrt{16 - 4(1)(5)}}{2(1)} = \frac{4 \pm \sqrt{16-20}}{2} = \frac{4 \pm \sqrt{-4}}{2} = \frac{4 \pm 2i}{2} = \boxed{2 \pm i}$$

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$$Given: f(x) = x^3 - x^2 - 7x + 15$$

6. Find the instantaneous rate of change at x = 3:

a. numerically

$$\frac{f(3.001) - f(3)}{3.001 - 3}$$

$$\frac{12.014 - 12}{.001}$$

$$\frac{.014}{.001} \approx \boxed{14}$$

b. algebraically

$$\frac{f(x) - f(3)}{x - 3} = \frac{(x^3 - x^2 - 7x + 15) - 12}{x - 3}$$

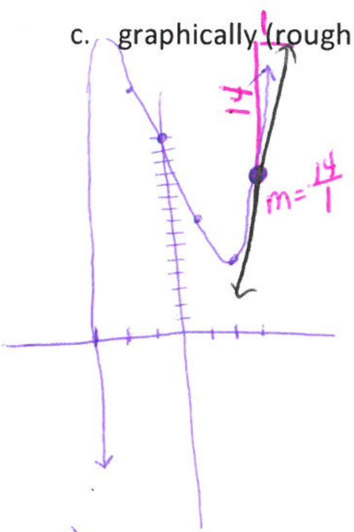
3	1	-1	-7	3
	↓	3	6	-3
	1	2	-1	0

$x^2 + 2x - 1$

$(3)^2 + 2(3) - 1$

$\boxed{14}$

c. graphically (rough sketch)



draw line tangent to the graph @ x = 3, then find/estimate the slope of that tangent line (not very accurate)

d. Find the equation of the line tangent to the graph at $x = 3$.

$y = mx + b$

f(3) f'(3) 3

$12 = 14(3) + b$

$12 = 42 + b$

$-30 = b$

$\boxed{y = 14x - 30}$

7. a) Find the derivative using the general power rule. b) Then find $f'(4)$. c) What does this mean?

a) $f'(x) = 3x^2 - 2x - 7$

b) $f'(4) = 3(4)^2 - 2(4) - 7 = \boxed{33}$

c) means the instantaneous rate at x = 4 is 33

8. Use the derivative to find the extreme(s).

at extremes, derivative = 0 because tangent line is horizontal

$0 = 3x^2 - 2x - 7$

$\boxed{x = 1.897 \quad x = -1.230}$