Continuity: f(a) must exist. $\lim_{x \to a} f(a) = f(a)$

Limits

$\lim_{x \to a+} f(a)$ must equal $\lim_{x \to a-} f(a)$ and both limits exist or else the limit DNE

f(x)	increasing / decreasing	positive / negative
f'(x)	positive / negative	increasing / decreasing
f''(x)		positive / negative

Interval Notation

Closed Circles mean use brackets : [a, b]

Open Circles mean use parentheses : (a, b)

If you have an open then closed circle use a parenthesis then a bracket : (a, b]

If you have two intervals a < x < b and c < x < d they can be in union so now write it as (a, b) U (c, d)

Properties of Log and Ln

$log_b mn = log_b m + log_b n$

$log_b m - log_b n = log_b \frac{m}{n}$

$log_b m^n$ = n $log_b m$

$log_b m = log_b n$ then m=n

Properties of Limits: http://bovcalculus.weebly.com/calculus-ab/lesson-17

Tangent Lines and Derivatives:

The slope of a curve at x=a is the slope of the tangent line at x=a

Derivative: f'(x) or $\frac{d}{dx} f(x) = \lim_{x \to h} \frac{f(x+h) - f(x)}{h}$

Function Composition

(f+g)(x) = f(x) + g(x)

(f · g)(x) = f(x) · g(x)

(f o g)(x) = f(g(x))

(gof)(x) = g(f(x))

Power Rule

f(x)= x^n f'(x)= $n x^{n-1}$

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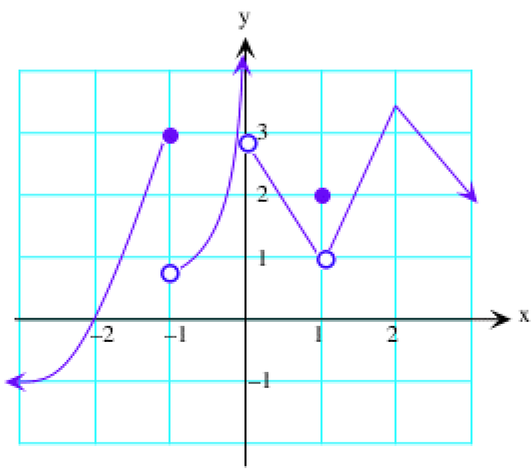
Practice Problems

1.) f(x) = x(x+2)(x-3)
   a.) What interval(s) is f'(x)<0 ?
   b.) What interval(s) is f'(x)>0 ?
   c.) Where is f'(x)=0 ?
   d.) Find all roots for f(x)
2.) h(x)= -x(x-5) (x+1), set ymax= 50 and ymin= -50
   a.) What interval(s) is f'(x)<0 ?
   b.) What interval(s) is f'(x)>0 ?
   c.) Where is f'(x)=0 ?
   d.) Find all roots for f(x)



3.)
   a.) $\lim_{x \to 2} f(x) =$
   b.) $\lim_{x \to 1} f(x) =$
   c.) $\lim_{x \to -2^+} f(x) =$
   d.) $\lim_{x \to -1} f(x) =$
   e.) Is f(x) continuous at x=1? Justify your answer using the definition of continuity

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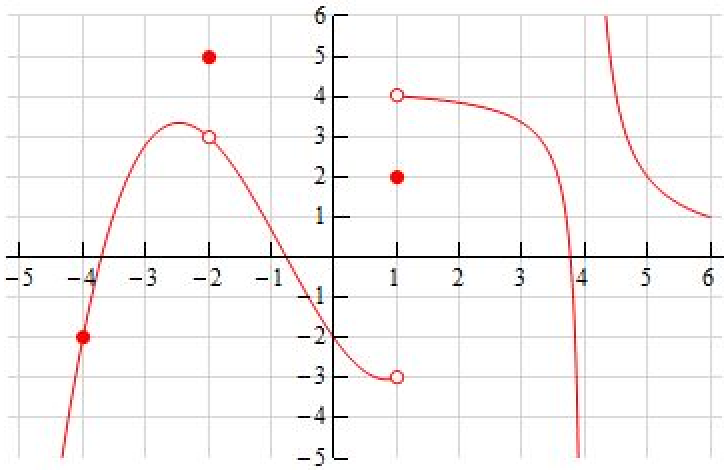
4.) 

a.) $\lim_{x \to 4} f(x) =$

b.) $\lim_{x \to -2} f(x) =$

c.) $\lim_{x \to 1^+} f(x) =$

d.) $\lim_{x \to 1^-} f(x) =$

e.) Is f(x) continuous at x=1? Justify your answer using the definition of continuity

5.) $\lim_{x \to \infty} \frac{x^2+4x+3}{x^4+5x+1} =$

6.) $\lim_{x \to \infty} \frac{x^3-5x^4+7}{3x^3-9x+1} =$

7.) $\lim_{x \to \infty} \frac{4x^4+5x^5+6}{x^4+2x+1} =$

8.) Use the definition of a derivative to find the derivative of each function

a.) g(x)= x^3 +1

b.) f(x)= $x^2 + 4x$

c.) h(x)= $x^4 + x^2$

9.) Find the derivative of the following

a.) A(x)= $6x^{-3}$ +5x+ $\frac{1}{x^3}$

b.) B(x)= $\sqrt[3]{x} + 4x^{-2}$

c.) V(x)= $\frac{1}{\sqrt{x}}$ +3 x^{-5}

10.) Solve for x in the following

a.) $log_4(25x+5) - log_4 5 = 2$

b.) $log_8(4x+3) + log_8 7 = 2$

11.) Find the equation of the line tangent to f(x)= $4x^2 + 2x + 1$ at the point x=3

12.) Find the equation of the line tangent to h(x)= $5x^3 + 4x^2$ at the point x=2

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ANSWER KEY

1.)
   a.) (-1.120, 1.786)
   b.) (-∞, -1.120), (1.786, ∞)
   c.) (1.786, -8.209), (-1.120, 4.061)
   d.) x= -2, x= 0, x= 3

2.)
   a.) (-∞, -.523), (3.189, ∞)
   b.) (-.523, 3.189)
   c.) (3.189, 24.193), (-.523, -1.378)
   d.) x= -1, x= 0, x= 5

3.)
   a.) 3
   b.) DNE
   c.) -∞
   d.) DNE
   e.) No, because $\lim_{x \to 1} f(x) \neq f(1)$

4.)
   a.) DNE
   b.) DNE
   c.) 4
   d.) -3
   e.) $\lim_{x \to 1^+} f(x) \neq \lim_{x \to 1^-} f(x) \neq f(1)$

5.) 0

6.) -∞

7.) ∞

8.)
   a.) 3x^2
   b.) 2x+4
   c.) 4x^3 +2x

9.)
   a.) $\frac{-21}{x^4}$ + 5
   b.) $\frac{1}{3}$ $x^{-2/3}$ - 8x^{-3}
   c.) $\frac{-1}{2}$ x^{-1} - 15x^{-6}

10.)
   a.) X = $\frac{17}{5}$
   b.) X = $\frac{43}{25}$

11.) y= 26x - 35

12.) y= 76x - 96

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