1) translate inequality statements into interval notation
2) limits for a piecewise-linear function
3) unconventional phrasing for a tangent-line task
4) tangent to cubic
5) derivative of $cos(x+a)$
6) identify function and its derivatives in a graph
7) $\lim_{x\to 0} \frac{\sin(ax)}{bx}$
8) figure to motivate l'Hopital's rule
9) implicit differentiation [problem is static]
10) slope of tangent to $2(x^2+y^2)^2 = 25(x^2-y^2)$
11) derivative of a $\arcsin(x^n)$
12) derivative of a $\cos\big(b\ln(x)\big)$
13) intervals of increase and decrease for cubic
14) confirm Rolle's Theorem for a quadratic
15) $\lim_{x\to 0^+} x^{a\sin(x)}$
16) $\int \frac{a}{x\cdot\ln(bx)}\,dx$
17) maximize area of Norman window with perimeter P
18) solve IVP: $f''(x) = ax+b$
19) differentiate $g(x) = \int_{ax}^{bx} \frac{u+c}{u-d}\,du$
20) definite integral: interval additivity, linear operator

Problems 2, 6, 8 create and display individualized graphs.

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1. **(1 pt) Library/Rochester/setAlgebra01RealNumbers/lhp1_31-34_mo.pg**

Sketch the following sets on a piece of paper and write them in interval notation. Enter the interval in the answer box. You may use "infinity" for ∞ and "-infinity" for $-\infty$. For example, you may write (-infinity, 5] for the interval $(-\infty, 5]$.

$16 \le x \le 19$ ________

$3 < x \le 8$ ________

$25 < x < 29$ ________

$12 \le x < 17$ ________

Answer(s) submitted:

- `[16,19]`
- `(3,8]`
- `(25,29)`
- `[12,17)`

(correct)

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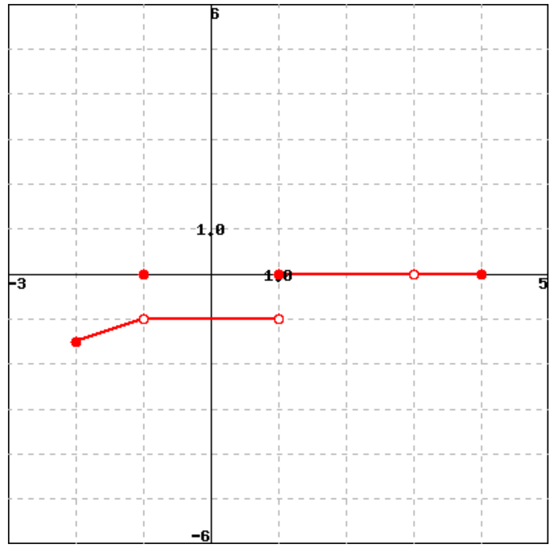
2. **(1 pt) Library/Rochester/setLimitsRates1_5Graphs/ur_lr_1-5_1_mo.pg**

Let F be the function below.



Evaluate each of the following expressions.

Note: Enter 'DNE' if the limit does not exist or is not defined.

a) $\lim_{x\to -1^-} F(x)$ = ___

b) $\lim_{x\to -1^+} F(x)$ = ___

c) $\lim_{x\to -1} F(x)$ = ___

d) $F(-1)$ = ___

e) $\lim_{x\to 1^-} F(x)$ = ___

f) $\lim_{x\to 1^+} F(x)$ = ___

g) $\lim_{x\to 1} F(x)$ = ___

h) $\lim_{x\to 3} F(x)$ = ___

i) $F(3)$ = ___

Answer(s) submitted:

- `-1`
- `-1`
- `-1`
- `0`
- `-1`
- `0`
- `dne`
- `0`
- `dne`

(correct)

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3. **(1 pt) Library/Rochester/setDerivatives1_5Tangents-/ur_dr_1_5_16_mo.pg**

For what values of a and b is the line $-4x+y=b$ tangent to the curve $y=ax^3$ when $x=-5$?

$a =$ ________

$b =$ ________

Answer(s) submitted:

-
-

(incorrect)

4. **(1 pt) Library/Rochester/setDerivatives1_5Tangents-/ur_dr_1_5_2a_mo.pg**

Let $h(x) = 4 - 4x^3$,

$h'(3) =$ ______

Use this to find the equation of the tangent line to the curve $y = 4 - 4x^3$ at the point $(3, -104)$ and write your answer in the form:

$y = mx + b$, where m is the slope and b is the y-intercept.

______

Answer(s) submitted:

-
-

(incorrect)

5. **(1 pt) Library/Rochester/setDerivatives1/s2_1_23_mo.pg**

Let $f(x) = \cos(x+5)$,

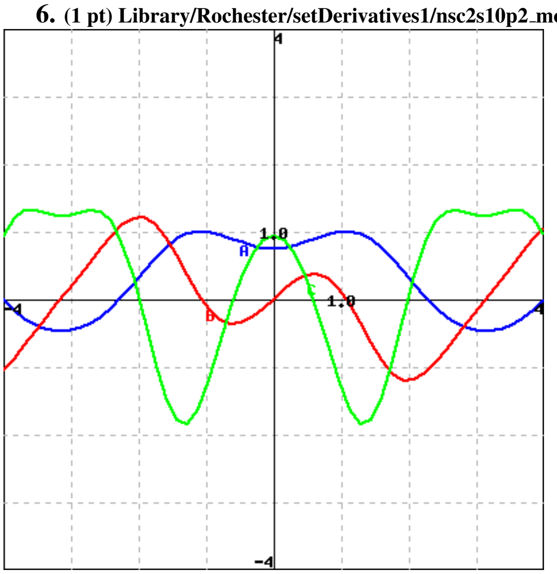
$f'(3) =$ ______

Answer(s) submitted:

-

(incorrect)

6. **(1 pt) Library/Rochester/setDerivatives1/nsc2s10p2_mo.pg**



Identify the graphs A (blue), B(red) and C (green) as the graphs of a function and its derivatives:

___ is the graph of the function

___ is the graph of the function's first derivative

___ is the graph of the function's second derivative

Answer(s) submitted:

- a
- f
- f

(score 0.333333333333333)

7. **(1 pt) Library/Rochester/setDerivatives4Trig/s2_4_7_mo.pg**

Evaluate the limit $\lim_{x\to 0} \frac{\sin(2x)}{7x} =$ ______

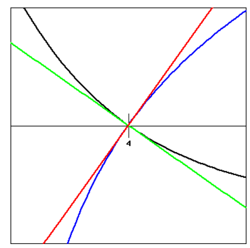
Answer(s) submitted:

-

(incorrect)

8. **(1 pt) Library/Michigan/Chap4Sec7/Q15.pg**

The functions f and g and their tangent lines at $(4, 0)$ are shown in the figure below.



f is shown in blue, g in black, and the tangent line to f is $y = 1(x-4)$, and is graphed in green, and the tangent line to g is $y = -0.5(x-4)$, and is graphed in red.

Find the limit

$\lim_{x\to 4} \dfrac{f(x)}{g(x)} =$ ___

SOLUTION: (Instructor solution preview: show the student solution after due date.)

SOLUTION

Observe that both $f(4)$ and $g(4)$ are zero. Also, $f'(4) = 1$ and $g'(4) = -0.5$, so by l'Hopital's rule,

$$\lim_{x\to 4} \frac{f(x)}{g(x)} = \frac{f'(4)}{g'(4)} = \frac{1}{-0.5} = -2.$$

Answer(s) submitted:

-

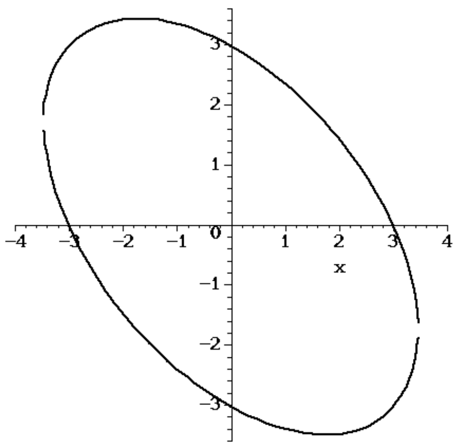
(incorrect)

9. **(1 pt) Library/Utah/Calculus_I/set5_The_Derivative/1210s5p17-/1210s5p17.pg**

The graph of the equation

$$x^2 + xy + y^2 = 9$$

is a slanted ellipse illustrated in this figure:



Think of y as a function of x. Differentiating implicitly and solving for y' gives:
$y' =$ ________. (Your answer will depend on x and y.)

The ellipse has two horizontal tangents. The upper one has the equation

$y =$ ____.
The right most vertical tangent has the equation
$x =$ ____.
That tangent touches the ellipse where
$y =$ ______.

Hint: The horizontal tangent is of course characterized by $y' = 0$. To find the vertical tangent use symmetry, or think of x as a function of y, differentiate implicitly, solve for x' and then set $x' = 0$.

SOLUTION: (Instructor solution preview: show the student solution after due date.)

Solution: Differentiating implicitly in

$$x^2 + xy + y^2 = 9$$

gives

$$2x + y + xy' + 2yy' = 0.$$

Solving for y' gives

$$y' = -\frac{2x+y}{x+2y}.$$

Setting

$$y' = 0$$

and solving for x gives

$$2x + y = 0 \quad \Longrightarrow \quad x = -\frac{y}{2}.$$

Substituting in the original equation gives

$$\frac{y^2}{4} - \frac{y^2}{2} + y^2 = 9.$$

Thus

$$\frac{3y^2}{4} = 9$$

or

$$y^2 = 12.$$

Hence the horizontal asymptotes have the equations

$$y = \pm\sqrt{12}.$$

The plus sign gives the upper asymptote, the minus sign the lower. By symmetry the vertical asymptotes have the equations

$$x = \pm\sqrt{12}.$$

The rightmost vertical asymptote with the equation

$$x = \sqrt{12}$$

touches the ellipse in the point where

$$y = -\frac{x}{2} = -\frac{\sqrt{12}}{2} = -\sqrt{3}.$$

Answer(s) submitted:

-
-
-
-

(incorrect)

---

10. **(1 pt) Library/Rochester/setDerivatives2_5Implicit/s2_6_25a_mo.pg**
Find the slope of the tangent line to the curve (a lemniscate)

$$2\left(x^2+y^2\right)^2 = 25\left(x^2-y^2\right)$$

at the point $(3, -1)$.

$m =$ ________

Answer(s) submitted:

-

(incorrect)

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11. **(1 pt) Library/maCalcDB/setDerivatives6InverseTrig-/sc3_6_25_mo.pg**
Let

$$f(x) = 4\sin^{-1}\left(x^2\right)$$

$f'(x) =$ ________________

NOTE: The webwork system will accept arcsin(x) or sin^-1(x) as the inverse of $\sin(x)$.

Answer(s) submitted:

-

(incorrect)

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12. **(1 pt) Library/Rochester/setDerivatives7Log/sc3_7_4_mo.pg**
If $f(x) = 5\cos(6\ln(x))$, find $f'(x)$.

____

Find $f'(3)$.

____

Answer(s) submitted:

-
-

(incorrect)

13. **(1 pt) Library/Rochester/setDerivatives10MaxMin/c3s3p1_mo.pg**
The function
$$f(x) = 4x^3 + 6x^2 - 240x - 7$$
is decreasing on the interval ________.

Enter your answer using the interval notation for open intervals.

It is increasing on the interval(s) ________.
The function has a local maximum at ____.

SOLUTION: (Instructor solution preview: show the student solution after due date.)

Solution:
To find the intervals of increase and decrease, we have to find the intervals where the derivative is positive and where it is negative.
$f'(x) = 12x^2 + 12x - 240$.
The derivative is 0 when $12x^2 + 12x - 240 = 0$.
$12(x^2 + 1x - 20) = 0$
$12(x+5)(x-4) = 0$
We have two roots: $x = -5$ and $x = 4$.
It is easy to check that $f'(x)$ is negative (and therefore $f(x)$ is decreasing) on the interval $(-5,4)$.
$f'(x)$ is positive (and therefore $f(x)$ is increasing) on the interval $(-\infty,-5)$ and on the interval $(4,\infty)$.
Since $f'(x)$ changes from positive to negative at -5, $f(x)$ has a local maximum at -5.

Answer(s) submitted:

-
-
-

(incorrect)

14. **(1 pt) Library/ma122DB/set7/s4_2_1_mo.pg**
Consider the function $f(x) = x^2 - 4x + 6$ on the interval $[0,4]$. Verify that this function satisfies the three hypotheses of Rolle's Theorem on the inverval.

$f(x)$ is ____ on $[0,4]$;
$f(x)$ is ____ on $(0,4)$;
and $f(0) = f(4) =$ ________.

Then by Rolle's theorem, there exists a c such that $f'(c) = 0$. Find the value c.
$c =$ ____

Answer(s) submitted:

-
-
-
-

(incorrect)

15. **(1 pt) Library/ma122DB/set8/s4_4_55_mo.pg**

Evaluate the limit using L'Hospital's rule if necessary.
$$\lim_{x\to 0^+} x^{6\sin(x)}$$

Answer: ______

Answer(s) submitted:

-

(incorrect)

16. **(1 pt) Library/Rochester/setIntegrals14Substitution-/sc5_5_25_mo.pg**
Find **one** indefinite integral (anti-derivative):
$$\int \frac{7}{x\ln(6x)}\,dx$$

____

Answer(s) submitted:

-

(incorrect)

17. **(1 pt) Library/Rochester/setDerivatives10_5Optim/s3_8_26_mo.pg**
A Norman window has the shape of a semicircle atop a rectangle so that the diameter of the semicircle is equal to the width of the rectangle. What is the area of the largest possible Norman window with a perimeter of 21 feet? ________

Answer(s) submitted:

-

(incorrect)

18. **(1 pt) Library/Rochester/setDerivatives20Antideriv-/c3s10p1_mo.pg**
Suppose $f''(x) = 4x + 1$ and $f'(0) = -3$ and $f(0) = 4$.

$f'(x) =$ ________
$f(1) =$ ________

Answer(s) submitted:

-
-

(incorrect)

19. **(1 pt) Library/maCalcDB/setIntegrals4FTC/sc5_4_19_mo.pg**
Find the derivative of
$$g(x) = \int_{3x}^{6x} \frac{u+2}{u-6}du$$

____

HINT: (Instructor hint preview: show the student hint after 1 attempts:)

Hint:
$$\int_{3x}^{6x} \frac{u+2}{u-6}du = \int_{0}^{6x} \frac{u+2}{u-6}du + \int_{3x}^{0} \frac{u+2}{u-6}du$$

Answer(s) submitted:

-

(incorrect)

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20. **(1 pt) Library/Rochester/setIntegrals0Theory/ur_in_0_13_mo.pg**

Suppose $\int_{-4}^{3.5} f(x)dx = 3$, $\int_{-4}^{-1.5} f(x)dx = 9$, $\int_{1}^{3.5} f(x)dx = 8$.

$\int_{-1.5}^{1} f(x)dx =$ _____

$\int_{1}^{-1.5} (3f(x) - 9)dx =$ _____

Answer(s) submitted:

-
-

(incorrect)