
1.(1 pt) Evaluate the expression $\frac{3^3}{3^{-4}}$.

_____

2.(1 pt) Evaluate the expression $64^{-4/3}$.

_____

[NOTE: Your answer can be an algebraic expression or fraction.]

3.(1 pt) The expression $\left(\frac{x^3y^3z^3x^{-2}}{x^5y^3z^5y^4}\right)^{-3}$ equals $x^ry^sz^t$
where r, the exponent of x, is: _____
and s, the exponent of y, is: _____
and finally t, the exponent of z, is: _____
[NOTE: Your answers can be algebraic expressions or fraction.]

4.(1 pt) Find the distance between (4, 7) and (-1, -1).

_____

5.(1 pt) The equation of the line with slope 4 that goes through the point $(8,5)$ can be written in the form $y = mx + b$ where m is: _____
and where b is: _____

6.(1 pt) The equation of the line that goes through the point $(1,9)$ and is parallel to the line $5x+4y = 2$ can be written in the form $y = mx + b$ where m is:

_____

and where b is: _____

7.(1 pt) The equation of the line that goes through the points $(-3,-7)$ and $(2,10)$ can be written in the form $y = mx + b$ where m is: _____
and where b is: _____

8.(1 pt) You arrive in Paris and the forcast is for a low of 17 and a high of 25 degrees Celsius. What is the forcasted low temperature in Fahrenheit?

_____

What is the forcasted high temperature in Fahrenheit?

_____

9.(1 pt) Consider the inequality

$$x^2 < 4x + 5.$$

The solution of this inequality consists of one or more of the following intervals: $(-\infty, A)$, (A, B), and (B, ∞) where $A < B$.

Find A _____
Find B _____

For each interval, answer YES or NO to whether the interval is included in the solution.
$(-\infty, A)$ _____
(A, B) _____
(B, ∞) _____

10.(1 pt) By completing the square, the expression $x^2 + 18x + 188$ equals $(x+A)^2 + B$
where A is: _____
and B is: _____

11.(1 pt) Let $f(x) = x^2 - 3$. Find the slope of the curve $y = f(x)$ at the point $x = 1$ by calculating $\frac{f(x+h)-f(x)}{h}$ and determining what number it approaches as h approaches 0.

$\frac{f(x+h)-f(x)}{h} =$ _____ Slope of $f(x)$ at $x = 1$: _____.

12.(1 pt) Let $f(x) = x^3$. Find the slope of the curve $y = f(x)$ at the point $x = 1$ by calculating $\frac{f(x+h)-f(x)}{h}$ and determining what number it approaches as h approaches 0.

$\frac{f(x+h)-f(x)}{h} =$ _____ Slope of $f(x)$ at $x = 1$: _____.

13.(1 pt) Let $f(x) = 2x + 5$. Find $f'(x)$ by calculating $\frac{f(x+h)-f(x)}{h}$ and determining what it approaches as h approaches 0.

$\frac{f(x+h)-f(x)}{h} =$ _____ $f'(x) =$ _____.

14.(1 pt) Let $f(x) = x^3 + x^2$. Find $f'(x)$ by calculating $\frac{f(x+h)-f(x)}{h}$ and determining what it approaches as h approaches 0.

$\frac{f(x+h)-f(x)}{h} =$ _____ $f'(x) =$ _____.

15.(1 pt) Suppose a pebble is dropped from the top of a four story building which is 64 feet high, and that its position $x(t)$ is given by $x(t) = 64 - 16t^2$ feet.

Find the instantaneous velocity
$v(t) = x'(t) =$ _____

and the time when the pebble hits the ground
$t =$ _____.

16.(1 pt) Suppose you throw a baseball 15 feet straight up and then catch it at the height you let go.

What is the net displacement of the baseball?

__________ feet.

What is the total distance traveled?

__________ feet.

17.(1 pt) A steam catapult aboard an aircraft carrier can accelerate an F-18 Hornet so that its velocity is given by

$$v(t) = 104.85t \text{feet/second.}$$

If the jet reaches its take-off velocity of 173 miles per hour at the end of the runway, how long does it take for the jet to take off?

__________ seconds.

How long is the runway?

__________ feet.

18.(1 pt) Consider the interval $[1,2]$. Find the areas under the following graphs on this interval.

$f(x) = x+1$

__________.

$g(x) = x^2$

__________.

1.(1 pt) The point $P(2,14)$ lies on the curve $y = x^2+x+8$. If Q is the point (x, x^2+x+8), find the slope of the secant line PQ for the following values of x.
If $x = 2.1$, the slope of PQ is: __________
and if $x = 2.01$, the slope of PQ is: __________
and if $x = 1.9$, the slope of PQ is: __________
and if $x = 1.99$, the slope of PQ is: __________
Based on the above results, guess the slope of the tangent line to the curve at $P(2,14)$. __________

2.(1 pt) If a ball is thrown straight up into the air with an initial velocity of 85 ft/s, its height in feet after t seconds is given by $y = 85t - 16t^2$. Find the average velocity for the time period begining when $t = 1$ and lasting
(i) 0.5 seconds __________
(ii) 0.1 seconds __________
(iii) 0.01 seconds __________
Finally based on the above results, guess what the instantaneous velocity of the ball is when $t = 1$. __________

3.(1 pt) The slope of the tangent line to the parabola $y = 2x^2+4x+3$ at the point $(1,9)$ is: __________
The equation of this tangent line can be written in the form $y = mx+b$ where m is: __________
and where b is: __________

4.(1 pt) The slope of the tangent line to the curve $y = 2\sqrt{x}$ at the point $(4, 4.0000)$ is: __________
The equation of this tangent line can be written in the form $y = mx+b$ where m is: __________
and where b is: __________

5.(1 pt) If an arrow is shot straight upward on the moon with a velocity of 50 m/s, its height (in meters) after t seconds is given by $h = 50t - 0.83t^2$.
What is the velocity of the arrow (in m/s) after 5 seconds? __________
After how many seconds will the arrow hit the moon? __________
With what velocity (in m/s) will the arrow hit the moon? __________

6.(1 pt) If $f(x) = 4x^2-2x-29$, find $f'(x)$.
____
Find $f'(4)$.
____
[NOTE: When entering functions, make sure that you put all the necessary *, (,), etc. in your answer.]

7.(1 pt) If $f(x) = (5x^2-7)(5x+2)$, find $f'(x)$.
____
[NOTE: Your answer should be a function in terms of the variable 'x' and not a number!]

8.(1 pt) For what values of x does the curve $y = 4x^2-8x+7$ have positive slope? Negative slope? Zero slope?
Positive slope: x _____ _____
Negative slope: x _____ _____
Zero slope: x _____ _____
Instructions: For each line, enter a relational sign (e.g. $=$, $<$, $>$, etc.) in the first answer box and a number in the second.

9.(1 pt) If a ball is thrown straight up in such a way that its height t seconds later is
$s(t) = -16t^2+32t+6$,
find the velocity of the ball at t seconds after it is thrown. At what time t does the ball reach its maximum height? (Hint: the velocity will be positive before this time and negative after it).
Velocity = __________.
Time at which maximum height is reached = __________.

10.(1 pt) Find $\int(7x^2-2x+6)dx$.
$\int(7x^2-2x+6)dx$ = __________ $+C$, where C is the integration constant.

11.(1 pt) Find the antiderivative of $4x^3-5x$ that has the value 4 when $x = 1$.
The desired antiderivative is: __________.

12.(1 pt) Find $\int_0^2(x^3+2)dx$.
$\int_0^2(x^3+2)dx$ = __________ $+C$.

13.(1 pt) A particle travels along a horizontal line so that its velocity at time t is $v(t) = 2t+3t^2+1$ feet per second. Suppose that at time $t = 1$ the particle is at the origin. What is the location of the particle at time $t = 3$?

Particle's location at $t = 3$ is: ______________ feet from the origin.

14.(1 pt) The domain of the function $f(x) = \sqrt{3x-32}$ is all real numbers in the interval $[A, \infty)$ where A equals _____

15.(1 pt) For each of the following functions, decide whether it is even, odd, or neither. Enter E for an EVEN function, O for an ODD function and N for a function which is NEITHER even nor odd.

NOTE: You will only have four attempts to get this problem right!

___1. $f(x) = x^3 + x^5 + x^7$
___2. $f(x) = x^8 + 3x^6 + 2x^7$
___3. $f(x) = x^8 - 6x^6 + 3x^6$
___4. $f(x) = x^{-2}$

16.(1 pt) This problem gives you some practice identifying how more complicated functions can be built from simpler functions.

Let $f(x) = x^3 - 27$and let $g(x) = x - 3$. Match the functions defined below with the letters labeling their equivalent expressions.

___1. $(f(x))^2$
___2. $g(f(x))$
___3. $(g(x))^2$
___4. $f(x^2)$

A. $729 - 54x^3 + x^6$
B. $-27 + x^6$
C. $9 - 6x + x^2$
D. $-30 + x^3$

17.(1 pt) Relative to the graph of

$$y = x^2$$

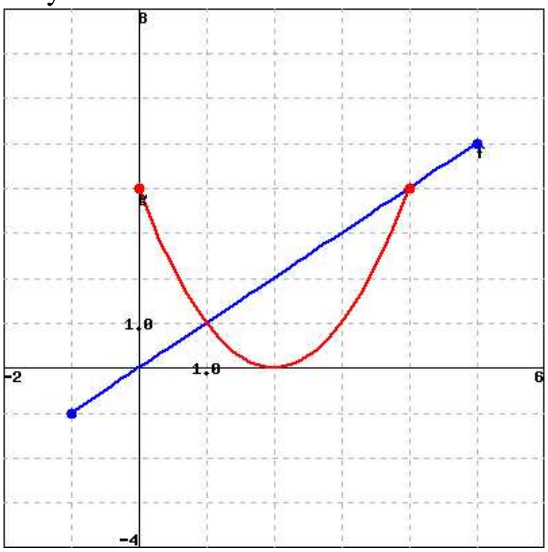
the graphs of the following equations have been changed in what way?

___1. $y = (x+13)^2$
___2. $y = (x-13)^2$
___3. $y = x^2 + 13$
___4. $y = (x^2)/3$

A. shifted 13 units left
B. compressed vertically by the factor 3
C. shifted 13 units right
D. shifted 13 units up

1.(1 pt) Let f be the linear function (in blue) and let g be the parabolic function (in red) below.

If you are having a hard time seeing the picture clearly, click on the picture. It will expand to a larger picture on its own page so that you can inspect it more closely.



Note: If the answer does not exist, enter 'DNE':

1. (f o g)(2) = ___
2. (g o f)(2) = ___
3. (f o f)(2) = ___
4. (g o g)(2) = ___
5. (f + g)(4) = ___
6. (f / g)(2) = ___

2.(1 pt) If f is one-to-one and $f(10) = 2$, then
$f^{-1}(2) =$ _____
and $(f(10))^{-1} =$ _____.
If g is one-to-one and $g(7) = 13$, then
$g^{-1}(13) =$ _____
and $(g(7))^{-1} =$ _____.
If h is one-to-one and $h(-12) = 2$, then
$h^{-1}(2) =$ _____
and $(h(-12))^{-1} =$ _____

3.(1 pt) If $f(x) = 4x - 13$, then
$f^{-1}(y) =$ __________
$f^{-1}(-5) =$ __________

4.(1 pt) If $f(x) = x^2, \quad x \geq 0$,
then $f^{-1}(10) =$ _____

5.(1 pt) Let

$$f(x) = \frac{x+3}{x+10}$$

$f^{-1}(-4) =$ __________

6.(1 pt) Let

$$f(x) = \frac{1}{5}x + 10, \quad 1 \leq x \leq 2$$

The domain of f^{-1} is the interval $[A, B]$
where $A =$ _____ and where $B =$ _____

7.(1 pt) For each of the following angles, find the degree measure of the angle with the given radian measure:
$\frac{5\pi}{6}$ _____
$\frac{3\pi}{4}$ _____
$\frac{5\pi}{3}$ _____
$\frac{5\pi}{2}$ _____
3π _____

8.(1 pt) For each of the following angles, find the radian measure of the angle with the given degree measure (you can enter π as 'pi' in your answers):
40 _____
360 _____
-160 _____
40 _____
30 _____

9.(1 pt) For each of the followings angles (in radian measure), find the sin of the angle (your answer cannot contain trig functions, it must be an arithmetic expression or number):
$\frac{\pi}{6}$ _____
$\frac{\pi}{4}$ _____
$\frac{\pi}{3}$ _____
$\frac{\pi}{2}$ _____
π _____
2π _____

10.(1 pt) For each of the followings angles (in radian measure), find the cos of the angle (your answer cannot contain trig functions, it must be an arithmetic expression or number):
$\frac{\pi}{6}$ _____
$\frac{\pi}{4}$ _____
$\frac{\pi}{3}$ _____

$\frac{\pi}{2}$ _____
π _____
2π _____

11.(1 pt) If $\theta = \frac{3\pi}{4}$, then
$\sin(\theta)$ equals _____
$\cos(\theta)$ equals _____
$\tan(\theta)$ equals _____
$\sec(\theta)$ equals _____

12.(1 pt) If $\theta = \frac{-5\pi}{6}$, then
$\sin(\theta)$ equals _____
$\cos(\theta)$ equals _____
$\tan(\theta)$ equals _____
$\sec(\theta)$ equals _____

13.(1 pt) The angle of elevation to the top of a building is found to be 13° from the ground at a distance of 6000 feet from the base of the building. Find the height of the building.

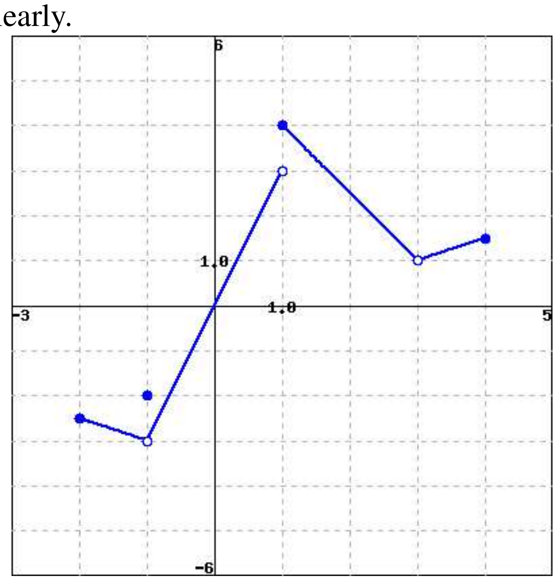
_____

14.(1 pt) A survey team is trying to estimate the height of a mountain above a level plain. From one point on the plain, they observe that the angle of elevation to the top of the mountain is 32°. From a point 1000 feet closer to the mountain along the plain, they find that the angle of elevation is 35°.
How high (in feet) is the mountain?

_____

15.(1 pt) Let F be the function below.

If you are having a hard time seeing the picture clearly, click on the picture. It will expand to a larger picture on its own page so that you can inspect it more clearly.



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) $lim_{x\to1^-}F(x) =$ ___
f) $lim_{x\to1^+}F(x) =$ ___
g) $lim_{x\to1}F(x) =$ ___
h) $lim_{x\to3}F(x) =$ ___
i) $F(3) =$ ___

16.(1 pt) Evaluate the limit

$$\lim_{x\to1}\frac{x-1}{x^2+7x-8}$$

_____

17.(1 pt) Evaluate the limit

$$\lim_{s\to1}\frac{s^3-1}{s^2-1}$$

_____

18.(1 pt) If $\lim_{x\to a} f(x) = 3$ and $\lim_{x\to a} g(x) = -1$ then

$$\lim_{x\to a}\frac{2f(x)-3g(x)}{f(x)+g(x)} =$$

_____

19.(1 pt) Evaluate the limit

$$\lim_{w\to-2}\sqrt{-3w^3+7w^2}$$

_____

20.(1 pt) Evaluate the right-hand limit

$$\lim_{x\to-\pi^+}\frac{\sqrt{\pi^3+x^3}}{x} =$$

_____

1.(1 pt) If

$$f(x)=\frac{\sqrt{x}-5}{\sqrt{x}+5}$$

find $f'(x)$.

____

Find $f'(4)$.

____

2.(1 pt) If $f(x)=6+\frac{6}{x}+\frac{2}{x^2}$, find $f'(x)$.

____

Find $f'(4)$.

____

3.(1 pt) Evaluate the limit

$$\lim_{x\to 0}\frac{\sin 3x}{6x}$$

_____

4.(1 pt) Evaluate the limit

$$\lim_{x\to 0}\frac{\sin 8x}{\sin 3x}$$

_____

5.(1 pt) Evaluate the limit

$$\lim_{x\to 0}\frac{\tan x}{4x}$$

_____

6.(1 pt) Evaluate the limit

$$\lim_{x\to\infty}\frac{2+3x}{4-6x}$$

____

7.(1 pt) Evaluate the limit

$$\lim_{x\to\infty}\frac{\sqrt{10+10x^2}}{(11+4x)}$$

____

8.(1 pt) Evaluate

$$\lim_{x\to\infty}\sqrt{x^2+1x+1}-x$$

____

9.(1 pt) For what value of the constant c is the function f continuous on $(-\infty,\infty)$ where

$$f(x)=\begin{cases} cx+2 & \text{if } x\in(-\infty,4] \\ cx^2-2 & \text{if } x\in(4,\infty) \end{cases}$$

____

10.(1 pt) If $f(x)=(4x^2-4)(3x+4)$, find $f'(x)$.

____

[NOTE: Your answer should be a function in terms of the variable 'x' and not a number!]

11.(1 pt) If $f(t)=\frac{13}{t^5}$, find $f'(t)$.

____

[NOTE: Your answer should be a function in terms of the variable 't' and not a number!]

12.(1 pt) If $f(x)=\frac{7x+5}{5x+6}$, find $f'(x)$.

____

Find $f'(4)$.

____

[NOTE: When entering functions, make sure that you put all the necessary *, (,), etc. in your answer.]

13.(1 pt)
Let $f(x)=-7x^4\sqrt{x}+\frac{6}{x^3\sqrt{x}}$.
$f'(x)=$ _______________
[NOTE: Your answer should be a function in terms of the variable 'x' and not a number! When entering functions, make sure that you put all the necessary *, (,), etc. in your answer.]

1.(1 pt) If

$$f(x) = \frac{\sqrt{x}-5}{\sqrt{x}+5}$$

find $f'(x)$.

Find $f'(5)$.

2.(1 pt) If $f(x) = \frac{7x+5}{3x+5}$, find $f'(x)$.

Find $f'(2)$.

[NOTE: When entering functions, make sure that you put all the necessary *, (,), etc. in your answer.]

3.(1 pt) If

$$f(x) = \frac{3\sin x}{2+\cos x}$$

find $f'(x)$.

Find $f'(2)$.

4.(1 pt) If $f(x) = \frac{3\tan x}{x}$, find $f'(x)$.

Find $f'(4)$.

5.(1 pt) If

$$f(x) = \frac{\tan x - 4}{\sec x}$$

find $f'(x)$.

Find $f'(5)$.

6.(1 pt) Let

$$f(x) = 4x\sin x\cos x$$

$f'(-\frac{\pi}{2}) =$ __________

7.(1 pt) If $f(x) = (x^2+4x+3)^3$, find $f'(x)$.

Find $f'(4)$.

8.(1 pt) If $f(x) = (5x+3)^{-4}$, find $f'(x)$.

Find $f'(1)$.

9.(1 pt) If $f(x) = \sin(x^5)$, find $f'(x)$.

Find $f'(4)$.

10.(1 pt) If $f(x) = \sin^2 x$, find $f'(x)$.

Find $f'(5)$.

11.(1 pt) If $f(x) = \tan 5x$, find $f'(x)$.

Find $f'(2)$.

12.(1 pt) Let

$$f(x) = \sin(\cos(x^3))$$

$f'(x) =$ __________

13.(1 pt) Let

$$f(x) = (-6x^2+2)^6(8x^2-4)^{14}$$

$f'(x) =$ __________

14.(1 pt) Let $f(x) = \frac{1-3x}{1+3x}$. Then $f'(3)$ is __________
and $f''(3)$ is __________
and $f'''(3)$ is __________

15.(1 pt) Find the 86 th derivative of the function $f(x) = \cos(x)$.
The answer is function __________

16.(1 pt) Let

$$f(x) = \frac{-9x}{1-x}$$

$f^{(4)}(x) =$ __________

17.(1 pt) The rate of change of electric charge with respect to time is called current. Suppose that $\frac{1}{3}t^3+t$ coulombs of charge flow through a wire in t seconds. (a) Find the current in amperes (coulombs per second) after 3 seconds. (b) When will a 20-ampere fuse in the line blow?

a) Current after 3 seconds: __________ amperes.
b) A 20-ampere fuse will blow at: _____ seconds.

18.(1 pt) The radius of a spherical balloon is increasing at the rate of 0.25 inch per second. If the radius is 0 at time $t = 0$, find the rate of change in the volume at time $t = 3$.

Rate of change in volume at $t = 3$: __________ inch^3/second.

19.(1 pt) Find all points on the graph of $y = \frac{1}{3}x^3 + x^2 - x$ where the tangent line has slope 1.

(__________,__________)

(__________,__________)

Instruction: Enter the points in order of increasing x-coordinate.

20.(1 pt) A space traveller is moving from left to right along the curve $y = x^2$. When she shuts off the engines, she will continue travelling along the tangent line at the point where she is at that time. At what point should she shut off the engines in order to reach the point (4,15)?

She should shut off the engine at (_____,_____)

21.(1 pt) Find all points on the graph of $y = 9\sin x\cos x$ where the tangent line has horizontal.

The tangent of graph is horizontal when

$x =$ __________ $+ k$__________,

where k is an integer.

Instruction: There are many ways to express the answere here. However, WeBWorK is expecting that you choose positive values for both answer boxes and the smallest possible value for the first one.

22.(1 pt) At time t seconds, the center of a bobbing cork is $2\sin t$ centimeters above (or below) water level. What is the velocity of the cork at $t = 0, \pi/2, \pi$?

Velocity at $t = 0$: __________ cm/s.

Velocity at $t = \pi/2$: __________ cm/s.

Velocity at $t = \pi$: __________ cm/s.

1.(1 pt) Use implicit differentiation to find the slope of the tangent line to the curve

$$\frac{y}{x-7y} = x^8 - 2$$

at the point $(1, \frac{-1}{-6})$.

$m =$ __________

2.(1 pt) A street light is at the top of a 16.000 ft. tall pole. A man 5.600 ft tall walks away from the pole with a speed of 3.500 feet/sec along a straight path. How fast is the tip of his shadow moving when he is 45.000 feet from the pole? __________

3.(1 pt) A spherical snowball is melting in such a way that its diameter is decreasing at the rate of 0.4 cm/min. At what rate is the volume of the snowball decreasing when the diameter is 14 cm? (Note the answer is a positive number).

____

4.(1 pt) Gravel is being dumped from a conveyor belt at a rate of 10 cubic feet per minute.

It forms a pile in the shape of a right circular cone, such that the ratio of the base diameter to the height is always equal to 1.

How fast is the height of the pile increasing when the pile is 21 feet high?

Recall that the volume of a right circular cone with height h and radius of the base r is given by

$$V = \frac{1}{3}\pi r^2 h$$

____

5.(1 pt) Use linear approximation to estimate the amount of paint in cubic centimeters needed to apply a coat of paint 0.030000 cm thick to a hemispherical dome with a diameter of 65.000 meters.

____

6.(1 pt) Let $y = 5x^2$.

Find the change in y, Δy when $x = 1$ and $\Delta x = 0.3$

____

Find the differential dy when $x = 1$ and $dx = 0.3$

____

7.(1 pt) Use linear approximation, i.e. the tangent line, to approximate $\sqrt[3]{125.4}$ as follows:

Let $f(x) = \sqrt[3]{x}$. The equation of the tangent line to $f(x)$ at $x = 125$ can be written in the form $y = mx + b$ where m is: __________ and where b is: __________

Using this, we find our approximation for $\sqrt[3]{125.4}$ is __________

8.(1 pt) The function

$$f(x) = 4x^3 - 30x^2 + 0x - 3$$

is decreasing on the interval (___ , ___).

It is increasing on the interval ($-\infty$, ___) and the interval (___, ∞).

The function has a local maximum at _____.

9.(1 pt) For $x \in [-12, 10]$ the function f is defined by

$$f(x) = x^6(x-4)^5$$

On which two intervals is the function increasing?

_____ to _____

and

_____ to _____

Find the region in which the function is positive: _____ to _____

Where does the function achieve its minimum? _____

10.(1 pt) The hands on a clock are of lengths 5 inches (minute hand) and 4 inches (hour hand). How fast is the distance between the tips of the hands changing at 3:00.

Rate of change of distance at 3:00 between the tips of the hands: __________ inch(es) per minute.

11.(1 pt) Einstein's Special Theory of Relativity says that mass m is related to velocity v by the formula

$$m = \frac{m_0}{\sqrt{1 - v^2/c^2}} = m_0 \left(1 - \frac{v^2}{c^2}\right)^{-1/2}.$$

Here, m_0 is the rest mass and c is the velocity of light. Use differentials to determine the percent increase in mass of an object when its velocity increases from $0.8c$ to $0.84c$.

Approximate percent increase: _____

12.(1 pt) Identify the critical points and find the maximum value and minimum value of the following function on the given interval.

$f(x) = x^3 - 3x + 1$, over $[-3/2, 3]$.

Critical Points: __________, __________.
Maximum: __________.
Minimum: __________.

Instructions:
1) When entering the critical points, please enter them in the order that they appear on the real line.
2) If the function has no critical points, enter the string NONE in all answer boxes for critical points.

13.(1 pt) Identify the critical points and find the maximum value and minimum value of the following function on the given interval.

$f(x) = \sqrt[3]{x}$, over $[-1, 27]$.

Critical Points: __________, __________.
Maximum: __________.
Minimum: __________.

Instructions:
1) When entering the critical points, please enter them in the order that they appear on the real line.
2) If the function has no critical points, enter the string NONE in all answer boxes for critical points.

14.(1 pt) What number exceeds its square by the maximum amount? Begin by convincing yourself that this number is on the interval [0,1].

Answer: __________.

15.(1 pt) A rectangle is to be inscribed in a semicircle of radius r with its base touching that of the semicircle. What are the dimensions of rectangle if its area is to be maximized?

Dimensions: __________ $r \times$ __________ r.

1.(1 pt) Answer the following questions for the function

$$f(x) = \frac{x^3}{x^2 - 36}$$

defined on the interval $[-16, 15]$.

Enter points, such as inflection points in ascending order, i.e. smallest x values first.

Enter intervals in ascending order also.

A. The function $f(x)$ has vertical asympototes at_____ and _____
B. $f(x)$ is concave up on the region _____ to _____ and _____ to _____
C. The inflection points for this function are _____, _____ and _____

2.(1 pt) Answer the following questions for the function

$$f(x) = sin^2(x/2)$$

defined on the interval $[-5.4831852, 1.3707963]$.

Enter points, such as inflection points in ascending order, i.e. smallest x values first.
Rememer that you can enter "pi" for π as part of your answer.

A. $f(x)$ is concave down on the region _____ to _____
B. A global minimum for this function occurs at _____
C. A local maximum for this function which is not a global maximum occurs at_____
D. The function is increasing on _____ to _____ and on _____ to _____.

3.(1 pt) The function $f(x) = 7x + 9x^{-1}$ has one local minimum and one local maximum.
It is helpful to make a rough sketch of the graph to see what is happening.
This function has a local minimum at x equals __________ with value __________
and a local maximum at x equals __________ with value __________

4.(1 pt) Consider the function $f(x) = 4(x-4)^{2/3}$. For this function there are two important intervals: $(-\infty, A)$ and (A, ∞) where A is a critical number.
Find A _____
For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).
$(-\infty, A)$: _____
(A, ∞): _____
For each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).
$(-\infty, A)$: _____
(A, ∞): _____

5.(1 pt) Consider the function $f(x) = 4x + 8x^{-1}$. For this function there are four important intervals: $(-\infty, A]$, $[A, B)$,$(B, C]$, and $[C, \infty)$ where A, and C are the critical numbers and the function is not defined at B.
Find A _____
and B _____
and C _____
For each of the following intervals, tell whether $f(x)$ is increasing (type in INC) or decreasing (type in DEC).
$(-\infty, A]$: _____
$[A, B)$: _____
$(B, C]$: _____
$[C, \infty)$ _____
Note that this function has no inflection points, but we can still consider its concavity. For each of the following intervals, tell whether $f(x)$ is concave up (type in CU) or concave down (type in CD).
$(-\infty, B)$: _____
(B, ∞): _____

6.(1 pt) 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 34 feet? _______________

7.(1 pt) Consider the function

$$f(x) = 1x^3 + 2x^2 + 4x + 3$$

Find the average slope of this function on the interval $(4, 12)$. __________

By the Mean Value Theorem, we know there exists a c in the open interval $(4,12)$ such that $f'(c)$ is equal to this mean slope. Find the value of c in the interval which works ____

8.(1 pt) Consider the function $f(x) = 6\sqrt{x}+4$ on the interval $[3,7]$. Find the average or mean slope of the function on this interval.

____

By the Mean Value Theorem, we know there exists a c in the open interval $(3,7)$ such that $f'(c)$ is equal to this mean slope. For this problem, there is only one c that works. Find it.

____

9.(1 pt) An object thrown from the edge of a 42-foot cliff follows the path given by $y = -\frac{2x^2}{25}+x+42$. An observer stands 2.6656 feet from the bottom of the cliff.

(a) Find the position of the object when it is closest to the observer.

(b) Find the position of the object when it is farthest from the observer.

Answers:

(a) (____ , ____).

(b) (____ , ____).

10.(1 pt) The illumination at a point is inversely proportional to the square of the distance of the point from the light source and directly proportional to the intensity of the light source. If two light sources are s feet apart and their intensities are I and J respectively, at what point between them will the sum of their illuminations be a minimum?

Solution:

Let x be the distance from I at which the sum of the illuminations be minimum. Then

$x =$ ____.

Instruction: Give your answer in terms of s, I and J.

11.(1 pt) Find the equation of the line that is tangent to the ellipse $b^2x^2 + a^2y^2 = a^2b^2$ in the first quadrant and forms with the coordinate axes the triangle with smallest possible area (a and b are positive constants.)

The equation of the required line is:

__ x + __ y + ____ $= 0$.

12.(1 pt) Find the indicated limit. Make sure that you have an indeterminate form before you apply l'Hopital's Rule.

$\lim_{x\to\pi/2} \frac{\cos x}{\frac{\pi}{2}-x} =$ ____.

Instruction: If your answer is ∞, enter "Infinity"; if it is $-\infty$, enter "-Infinity".

13.(1 pt) Find the indicated limit. Make sure that you have an indeterminate form before you apply l'Hopital's Rule.

$\lim_{x\to 0} \frac{x^3-3x^2+x}{x^3-2x} =$ ____.

Instruction: If your answer is ∞, enter "Infinity"; if it is $-\infty$, enter "-Infinity".

14.(1 pt) Find the indicated limit. Make sure that you have an indeterminate form before you apply l'Hopital's Rule.

$\lim_{x\to 0} \frac{\sin x - \tan x}{x^2 \sin x} =$ ____.

Instruction: If your answer is ∞, enter "Infinity"; if it is $-\infty$, enter "-Infinity".

15.(1 pt) Find the indicated limit. Make sure that you have an indeterminate form before you apply l'Hopital's Rule.

$\lim_{x\to 0^+} \frac{x^2}{\sin x - x} =$ ____.

Instruction: If your answer is ∞, enter "Infinity"; if it is $-\infty$, enter "-Infinity".

16.(1 pt) Find

$\lim_{x\to 0} \frac{x^2\sin(1/x)}{\tan x} =$ ____.

Instruction: If your answer is ∞, enter "Infinity"; if it is $-\infty$, enter "-Infinity".

17.(1 pt) Use a CAS (Computer Algebra System) to evaluate the following limit:

$\lim_{x\to 0} \frac{\cos x - 1 + x^2/2}{x^4} =$ ____.

Instruction: If your answer is ∞, enter "Infinity"; if it is $-\infty$, enter "-Infinity".

1.(1 pt) Evaluate the integral: $\int \frac{s(s+1)^2}{\sqrt{s}}ds.$
Answer: ______________ + C.

2.(1 pt) Evaluate the indefinite integral:
$\int \frac{3y}{\sqrt{2y^2+5}}dy.$
Answer: ______________ + C.

3.(1 pt) Find: $\int \sin^2 x dx.$
Answer: ______________ + C.

4.(1 pt) A car traveling at 47 ft/sec decelerates at a constant 6 feet per second squared. How many feet does the car travel before coming to a complete stop?

____

5.(1 pt) A ball is shot at an angle of 45 degrees into the air with initial velocity of 44 ft/sec. Assuming no air resistance, how high does it go?

____

How far away does it land?

____

Hint: The acceleration due to gravity is 32 ft per second squared.

6.(1 pt) Consider the function $f(t) = 8\sec^2(t) - 2t^2$. Let $F(t)$ be the antiderivative of $f(t)$ with $F(0) = 0$.
Then $F(5) =$ __________

7.(1 pt) Consider the function $f(x)$ whose second derivative is $f''(x) = 2x + 6\sin(x)$. If $f(0) = 2$ and $f'(0) = 4$, what is $f(5)$? ______________

8.(1 pt) Consider the function $f(x) = 9x^9 + 5x^7 - 8x^3 - 9$.
Enter an antiderivative of $f(x)$

____

9.(1 pt) A particle is moving with acceleration $a(t) = 24t + 4$. Its position at time $t = 0$ is $s(0) = 1$ and its velocity at time $t = 0$ is $v(0) = 4$. What is its position at time $t = 14$? ______________

10.(1 pt) A stone is dropped from the edge of a roof, and hits the ground with a velocity of -185 feet per second. How high (in feet) is the roof? ______________

11.(1 pt) Consider the differential equation:
$\frac{dy}{dx} = \sqrt{\frac{x}{y}}.$

a) Find the general solution to the above differential equation. (Instruction: Call your integration constant C.)

Answer: $y =$ ______________.

b) Find the particular solution of the above differential equation that satisfies the condition $y = 4$ at $x = 1$.

Answer: $y =$ ______________.

12.(1 pt) Consider the differential equation:
$\frac{du}{dt} = u^3(t^3 - t).$

a) Find the general solution to the above differential equation. (Instruction: Write the answer in a form such that its numerator is 1 and its integration constant is C — rename your constant if necessary.)

Answer: $u =$ ______________.

b) Find the particular solution of the above differential equation that satisfies the condition $u = 4$ at $t = 0$.

Answer: $u =$ ______________.

13.(1 pt) An object is moving along a coordinate line subject to acceleration a (in centimeters per second per second) as follows
$a = (1+t)^{-4}$
with initial velocity $v_0 = 0$ (in centimeters per second) and directed distance $s_0 = 10$ (in centimeters). Find both the velocity v and the directed distance s after 2 seconds.

Velocity after 2 seconds: __________ centimeter(s) per second.
Directed distance after 2 seconds: __________ centimeter(s).

14.(1 pt) The wolf population P in a certain state has been growing at a rate proportional to the cube root of the population size. The population was estimated at 1000 in 1980 and at 1700 in 1990.

a) Find the differential equation for $P(t)$ and the corresponding conditions. (Instruction: Use C for the constant of proportionality.)

$\frac{dP}{dt} =$ ________________________
$P($___$) =$___ and $P($___$) =$___

b) Solve your differential equation.
$P =$___________________.

c) When will the wolf population reach 4000?
The population will reach 4000 by the year _____.

15.(1 pt) Find $\sum_{k=3}^{7} \dfrac{(-1)^k 2^k}{k+1}$ = __________.

16.(1 pt) Find $\sum_{k=-1}^{6} k \sin(k\pi/2)$ = __________.

17.(1 pt) Find the value of the following collapsing sum:
$\sum_{k=1}^{10} (2^k - 2^{k-1})$ = __________.

18.(1 pt) Use the Special Sum Formulas (see Section 5.3 of Varberg, Purcell and Rigdon) to find:
$\sum_{i=1}^{10} ((i-1)(4i+3))$ = __________.

19.(1 pt) In statistics, we define the mean $\overline{x}$ and the variance s^2 of a sequence of numbers $x_1, \ldots, x_n$ by

$\overline{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$.

$s^2 = \frac{1}{n} \sum_{i=1}^{n} (x_i - \overline{x})^2$.

Find $\overline{x}$ and s^2 for the sequence of numbers 2, 5, 7, 8, 9, 10, 14.

$\overline{x} =$ __________.

$s^2 =$ __________.

1.(1 pt) Consider the integral

$$\int_{5}^{11} (3x^2 + 4x + 4)\, dx$$

(a) Find the Riemann sum for this integral using right endpoints and $n = 3$.

____

(b) Find the Riemann sum for this same integral, using left endpoints and $n = 3$

____

2.(1 pt) Evaluate the integral below by interpreting it in terms of areas. In other words, draw a picture of the region the integral represents, and find the area using high school geometry.

$$\int_{-6}^{6} \sqrt{36 - x^2} dx$$

____

3.(1 pt) Evaluate the integral by interpreting it in terms of areas. In other words, draw a picture of the region the integral represents, and find the area using high school geometry.

$$\int_{0}^{7} |5x - 5| dx$$

____

4.(1 pt)

$$\int_{1}^{8} f(x) - \int_{1}^{3} f(x) = \int_{a}^{b} f(x)$$

where a= _____ and b=_____

5.(1 pt) Consider the integral

$$\int_{1}^{5} \left(\frac{4}{x} + 4\right) dx$$

(a) Find the Riemann sum for this integral using right endpoints and $n = 4$.

____

(b) Find the Riemann sum for this same integral, using left endpoints and $n = 4$

____

6.(1 pt) Consider the function $f(x) = \frac{x^2}{3} + 8$.

In this problem you will calculate $\int_0^3 (\frac{x^2}{3} + 8)\, dx$ by using the definition

$$\int_{a}^{b} f(x)\, dx = \lim_{n \to \infty} \left[\sum_{i=1}^{n} f(x_i) \Delta x \right]$$

The summation inside the brackets is R_n which is the Riemann sum where the sample points are chosen to be the right-hand endpoints of each sub-interval.

Calculate R_n for $f(x) = \frac{x^2}{3} + 8$ on the interval $[0, 3]$ and write your answer as a function of n without any summation signs. You will need the summation formulas in Section 5.3 of your textbook.

$R_n =$__________

$\lim_{n \to \infty} R_n =$ __________

7.(1 pt) Compute the indefinite integral

$$\int (6x^7 + 3\sec(x)\tan(x)) dx$$

____

1.(1 pt) Evaluate the definite integral

$$\int_3^5 \frac{8x^2+5}{\sqrt{x}}dx$$

____

2.(1 pt) If $f(x) = \int_0^x (t^3+5t^2+5)\,dt$
then
$f''(x) =$ __________

3.(1 pt) If f(x) = $\int_2^{x^3} t^3 dt$
then
$f'(x) =$ ______________
$f'(6) =$ ______________

4.(1 pt) Given

$$f(x) = \int_0^x \frac{t^2-25}{1+\cos^2(t)}dt$$

At what value of x does the local max of $f(x)$ occur?
$x =$ __________

5.(1 pt) Let f be an odd function and g be an even function, and suppose that

$$\int_0^1 |f(x)|dx = \int_0^1 g(x)dx = 3.$$

Use geometric reasoning to calculate each of the following:
(a) $\int_{-1}^1 f(x)dx =$ ______________.
(b) $\int_{-1}^1 g(x)dx =$ ______________.
(c) $\int_{-1}^1 |f(x)|dx =$ ______________.
(d) $\int_{-1}^1 xg(x)dx =$ ______________.

6.(1 pt) Suppose that

$$\int_0^1 f(x)dx = 2, \int_1^2 f(x)dx = 3,$$

$$\int_0^1 g(x)dx = -1, \text{ and } \int_0^2 g(x)dx = 4.$$

Use properties of definite integrals (linearity, interval additivity, and so on) to calculate the following integral:

$$\int_0^2 (\sqrt{3}f(t) + \sqrt{2}g(t) + \pi)dt.$$

Answer: ______________.

7.(1 pt) Let

$$G(x) = \int_1^x xt\ dt.$$

Find
$G'(x) =$ ______________

8.(1 pt) Find

$$\lim_{x\to 1} \frac{1}{x-1}\int_1^x \frac{1+t}{2+t}\,dt.$$

Answer: ______________.

9.(1 pt) Use the Second Fundamental Theorem of Calculus combined with the Generalized Power Rule to evaluate the following integrals:
(a) $\int_0^{\pi/2} \sin^2 3x \cos 3x dx =$ _____.
(b) $\int_{-1}^x (t+|t|)dt =$ _____ for $x < 0$, and $\int_{-1}^x (t+|t|)dt =$ _____ for $x \geq 0$.

10.(1 pt) Find the average value of the following function on the given interval:

$$f(x) = \frac{x}{\sqrt{x^2+16}}, \text{ on } [0,3].$$

The average value of f on $[0,3]$ is __________.

11.(1 pt) View the following limit as a definite integral and then evaluate that integral by the Second Fundamental Theorem of Calculus.

$$\lim_{n\to\infty} \sum_{i=1}^n \frac{2}{n}\left[1+\frac{2i}{n}+\left(\frac{2i}{n}\right)^2\right].$$

The above limit is equal to ______________.

12.(1 pt) Use the method of substitution to find the following indefinite integral:

$$\int \frac{z\cos(\sqrt[3]{z^2+3})}{(\sqrt[3]{z^2+3})^2}dz.$$

Answer: ______________ + C.

13.(1 pt) Use the method of substitution to find the following definite integral:

$$\int_{-\pi/2}^{\pi/2} \cos\theta\cos(\pi\sin\theta)d\theta.$$

Answer: ______________.

1.(1 pt) Sketch the region enclosed by the given curves. Decide whether to integrate with respect to x or y. Then find the area of the region.
$x+y^2=30, x+y=0$

______

2.(1 pt) Sketch the region enclosed by the given curves. Decide whether to integrate with respect to x or y. Then find the area of the region.
$y=9\cos x, y=(6sec(x))^2, x=-\pi/4, x=\pi/4$

______

3.(1 pt) An object moves along a line so that its velocity at time t is $v(t)=\frac{1}{2}+\sin 2t$ feet per second. Find the displacement and the total distance traveled by the object for $0 \le t \le 3\pi/2$.

Displacement: ____ feet.

Total distance traveled: ____ feet.

4.(1 pt) Find the volume of the solid obtained by rotating the region bounded by the given curves about the specified axis.
$y=x^6, y=1;$ about $y=3$

______

5.(1 pt) You wake up one morning, and find yourself wearing a toga and scarab ring. Always a logical person, you conclude that you must have become an Egyptian pharoah. You decide to honor yourself with a pyramid of your own design. You decide it should have height $h=3360$ and a square base with side $s=1980$
To impress your Egyptian subjects, find the volume of the pyramid.

______

6.(1 pt) A ball of radius 13 has a round hole of radius 7 drilled through its center. Find the volume of the resulting solid.

______

7.(1 pt) Find the volume of the solid formed by rotating the region inside the first quadrant enclosed by
$y=x^4$
$y=27x$
about the x-axis.

______

8.(1 pt) Find the volume of the solid generated by revolving about the x-axis the region bounded by the upper half of the ellipse

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

and the x-axis, and thus find the volume of a prolate spheroid. Here a and b are positive constants, with $a>b$.

Volume of the solid of revolution: ____.

9.(1 pt) The region bounded by $y=2+\sin x$, $y=0$, $x=0$ and 2π is revolved about the y-axis. Find the volume that results.

Hint:

$$\int x\sin x\, dx = \sin x - x\cos x + C.$$

Volume of the solid of revolution: ____.

10.(1 pt) Find the length of the curve defined by

$$y=4x^{3/2}+3$$

from $x=2$ to $x=6$.

______

11.(1 pt) Consider the parametric curve given by the equations

$$x(t)=t^2+36t+43$$
$$y(t)=t^2+36t-12$$

How many units of distance are covered by the point P(t) = (x(t),y(t)) between t=0, and t=10 ?

______

12.(1 pt) Find the length of the following curve:

$$y=\int_{\pi/6}^{x}\sqrt{64\sin^2 u\cos^4 u-1}\, du, \quad \frac{\pi}{6}\le x\le\frac{\pi}{3}.$$

Length of the curve: ____.

13.(1 pt) Find the area of the surface generated by revolving the following curve about the axis:

$$x=r\cos t, y=r\sin t, 0\le t\le\pi.$$

Area of the surface: ____.

14.(1 pt) The circle $x=a\cos t, y=a\sin t, 0\le t\le 2\pi$ is revolved about the line $x=b, 0<a<b$, thus generating a torus (doughnut). Find its surface area.

Area of the torus: ____.

15.(1 pt) A force of 3 pounds is required to hold a spring stretched 0.6 feet beyond its natural length. How much work (in foot-pounds) is done in stretching the spring from its natural length to 0.8 feet beyond its natural length? ________

16.(1 pt) For a certain type of nonlinear spring, the force required to keep the spring stretched a distance s is given by the formula

$$F = ks^{4/3}.$$

If the force required to keep it stretched 8 inches is 2 pounds, how much work is done in stretching this spring 27 inches?

Amound of work done: ____ inch-pound(s).

17.(1 pt) The masses and coordinates of a system of particles are given by the following:

$$5,(-3,2);\ 6,(-2,-2);\ 2,(3,5);\ 7,(4,3);\ 1,(7,-1).$$

Find the moments of this system with respect to the coordinate axes, and find the coordinates of the center of mass.

Moment with respect to the x-axis: ____.
Moment with respect to the y-axis: ____.
Center of mass: (____,____).

18.(1 pt) Find the centroid of the region bounded by the following curves:

$$y = x^2, y = x+3.$$

Hint: Make a sketch and use symmetry where possible.

Centroid: (____,____).

19.(1 pt) Use Pappus's Theorem to find the volume of the torus obtained when the region inside the circle $x^2 + y^2 = a^2$ is revolved about the line $x = 2a$.

Volume of torus: ____.