MAT 1475 Final Exam Review Sheet

1. **(1 point)** setFinal1475/PFinalBucket01Limits1Continuitysmooth-reduceable-ratl.pg

$$f(x) = \begin{cases} \dfrac{x^2 - 3x - 10}{x^2 + 12x + 20}, & x \neq -2 \\ C, & x = -2 \end{cases}$$

What value of C would make $f(x)$ continuous at $x = -2$? ___

- Decimal approximations are not allowed for this problem.
- Compute the exact value for C and express your answer algebraically.

Correct Answers:

- -7/8

2. **(1 point)** setFinal1475/CityTechCalculussetLimits_-_Limit_Propertiesintermediate-properties.pg

Given that:

$$\lim_{x\to 6} f(x) = 3 \qquad \lim_{x\to -1} f(x) = 7$$

$$\lim_{x\to 6} g(x) = -7 \qquad \lim_{x\to -1} g(x) = 0$$

Apply the properties of limits to solve the following problems. If the limit cannot be determined, write: unknown

1. $\lim\limits_{x\to 6} \left(\dfrac{g(x)}{f(x) - 3} \right) =$___
2. $\lim\limits_{x\to -1} \left(g^2(x) - 3f(x)g(x) - 5f^2(x) \right) =$___
3. $\lim\limits_{x\to 6} \left(\sqrt{g(x) + 12} \right) =$___
4. $\lim\limits_{x\to -1} (5) =$___

Correct Answers:

- unknown
- -245
- 2.23607
- 5

3. **(1 point)** setFinal1475/CityTechCalculussetLimits_-_Limit_Propertiesbasic-properties.pg

Given that:

$$\lim_{x\to -8} f(x) = -5 \qquad \lim_{x\to -7} f(x) = 6$$

$$\lim_{x\to -8} g(x) = -7 \qquad \lim_{x\to -7} g(x) = 3$$

Apply the properties of limits to solve the following problems:

1. $\lim\limits_{x\to -7} \left(\dfrac{f^2(x)}{4g(x)} \right) =$___
2. $\lim\limits_{x\to -8} (4f(x) + 10g(x)) =$___
3. $\lim\limits_{x\to -8} \left(f^2(x) - g^2(x) \right) =$___
4. $\lim\limits_{x\to -8} (f(x) + g(x)) =$___

Correct Answers:

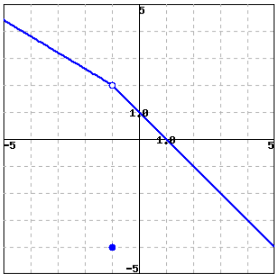
- 36/12
- -90
- -24
- -12

4. **(1 point)** setFinal1475/CityTechCalculussetLimits_-_One-Sidedintro-piecewise_no_explanation.pg

One-sided Limits

Use the graphs to determine the value of each expression below:

Graph A



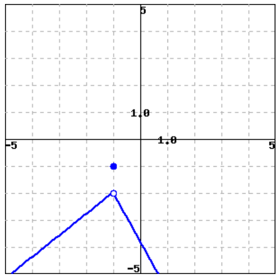
$f(-1) =$___

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

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

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

Graph B



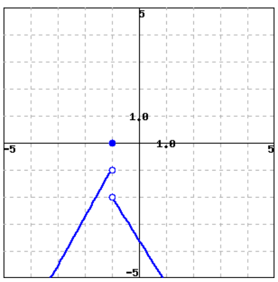
$f(-1) =$___

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

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

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

Graph C



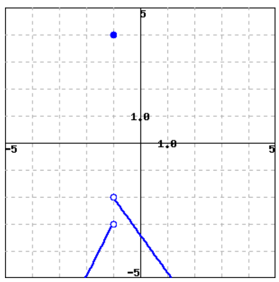
$f(-1) =$___

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

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

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

Graph D



$f(-1) =$___

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

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

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

- all answers should be given as numbers
- if a result does not exist, respond with “DNE” or “undefined”

Correct Answers:

- `-4; 2; 2; 2`
- `-1; -2; -2; -2`
- `0; -1; -2; DNE`
- `4; -3; -2; DNE`

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5. **(1 point)** `setFinal1475/CityTechCalculussetLimits_-_One-Sidedequation-piecewise_no_explanation.pg`

One-sided Limits

Use the given equations to determine the value of each expression below:

$$f(x) = \begin{cases} x+4, & x \le -3 \\ 5x+14, & x > -3 \end{cases}$$

$$g(x) = \begin{cases} -8x+14, & x < 2 \\ 6x-14, & x \ge 2 \end{cases}$$

$f(-3) =$ ___

$g(2) =$ ___

$\lim_{x\to -3^-} f(x) =$ ___

$\lim_{x\to 2^-} g(x) =$ ___

$\lim_{x\to -3^+} f(x) =$ ___

$\lim_{x\to 2^+} g(x) =$ ___

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

$\lim_{x\to 2} g(x) =$ ___

- all answers should be given as numbers
- if a result does not exist, respond with “DNE” or “undefined”

Correct Answers:

- `1; 1; -1; DNE`
- `-2; -2; -2; -2`

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6. **(1 point)** `setFinal1475/LHopitals_Rule4.5.19wConstant.pg`

Apply L’Hôpital’s Rule to evaluate the following limit. It may be necessary to apply it more than once.

$\lim_{x\to -\infty} \dfrac{-x-7}{-4x-1} =$ __________

Correct Answers:

- `1/4`

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7. **(1 point)** `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.5_LHopitals_Rule/4.5.22.pg`

Use L’Hôpital’s Rule (possibly more than once) to evaluate the following limit

$\lim_{x\to\infty} \left(\frac{3x^3+9x^2}{4x^3-12}\right) =$ __________

If the answer equals ∞ or $-\infty$, write INF or -INF in the blank.

Correct Answers:

- `0.75`

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8. **(1 point)** `Library/UCSB/Stewart5_4_4/Stewart5_4_4_10.pg`

Find the limit. Use l’Hospital’s Rule if appropriate. Use INF to represent positive infinity, NINF for negative infinity, and D for the limit does not exist.

$\lim_{x\to 0} \dfrac{x+\tan x}{9\sin x} =$ __________

Correct Answers:

- `0.222222222222222`

9. **(1 point)** Library/Michigan/Chap4Sec7/Q17.pg

Find the limit: $\lim_{x\to 3} \frac{\ln(x/3)}{x^2-9} =$ ______

(Enter **undefined** *if the limit does not exist.)*

Correct Answers:

- 1/18

10. **(1 point)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.5_LHopitals_Rule/4.5.40.pg

Apply L'Hôpital's Rule to evaluate the following limit. It may be necessary to apply it more than once.

$\lim_{x\to 1} \frac{\ln(x)}{e^{-x}-\frac{1}{e}} =$ ______

Correct Answers:

- -2.71828

11. **(1 point)** Library/UCSB/Stewart5_4_4/Stewart5_4_4_21.pg

Find the limit. Use l'Hospital's Rule if appropriate. Use INF to represent positive infinity, NINF for negative infinity, and D for the limit does not exist.

$\lim_{x\to 0} \frac{4e^x-4-4x}{10x^2} =$ ______

Correct Answers:

- 0.2

12. **(1 point)** setFinal1475/Rogawski_Calculus_Early_Transcendentals3_Differentiation3.10_Implicit_Differentiation3.10.17.pg

Calculate the derivative of y with respect to x, if $x^7-9x+y^4=81$.

$\frac{dy}{dx} =$ ______

Now find the equation of the tangent line to the curve at the point $(0,-3)$.

$y =$ ______

Correct Answers:

- (9-7*x^6)/(4*y^3)
- -(0.0833333*x+3)

13. **(1 point)** setFinal1475/Rogawski_Calculus_Early_Transcendentals_Second_Edition3_Differentiation3.10_Implicit_Differentiation3.10.11.pg

Calculate the derivative of y with respect to x, if $x^3y+3xy^3=x+y$.

$\frac{dy}{dx} =$ ______

Now find the equation of the tangent line to the curve at the point $(0,0)$.

$y =$ ______

Correct Answers:

- (1-3*x^2*y-3*y^3)/(x^3+9*x*y^2-1)
- -x

14. **(1 point)** Library/UVA-Stew5e/setUVA-Stew5e-C03S06-ImplicitDiff/3-6-01a.pg

Use implicit differentiation to find the slope of the tangent line to the curve defined by $3xy^4+7xy=40$ at the point $(4,1)$.

The slope of the tangent line to the curve at the given point is ____.

Correct Answers:

- -5/38

15. **(1 point)** Library/UVA-Stew5e/setUVA-Stew5e-C03S06-ImplicitDiff/3-6-20.pg

Find the slope of the tangent line to the curve

$$4\sin(x)+3\cos(y)-3\sin(x)\cos(y)+x=7\pi$$

at the point $(7\pi,3\pi/2)$.

______

Correct Answers:

- 1

16. **(1 point)** Library/OSU/high_school_apcalc/dcfrev/prob6.pg

Find $\frac{dy}{dx}$ when $5x^2+3x^3y-3y^2=56$.

$\frac{dy}{dx} =$ ______

The slope of the tangent line to this curve at the point $(2,2)$ is ____.

The equation of the tangent line to this curve at this point is

$y =$ ______

Correct Answers:

- (10*x+9*x^2*y)/(6*y-3*x^3)
- -23/3
- 2-23/3*(x-2)

17. **(1 point)** Library/maCalcDB/setDerivatives2_5Implicit/s2_6_25_mo.pg

Find an equation of the tangent line to the curve

$$2(x^2+y^2)^2=25(x^2-y^2)$$

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

An **equation** of the tangent line to the lemniscate at the given point is ____.

Correct Answers:

- 9*x-13*y = -40

18. **(1 point)** setFinal1475/UMNcalculusStewartCCCs_3_5_23.pg

Use implicit differentiation to find the derivative of y with respect to x and an equation of the tangent line to the **ellipse** defined by $2x^2 + 2xy + 5y^2 = 153$ at the point $(-2, -5)$.

$\frac{dy}{dx} =$ ______

An equation of the tangent line is $y =$ ______.

Correct Answers:

- -[(4*x+2*y)/(2*x+10*y)]
- x+3*y = -17

19. **(1 point)** setFinal1475/MichiganChap3Sec7Q29.pg

Find the slope of the tangent line to the ellipse $\dfrac{x^2}{9} + \dfrac{y^2}{25} = 1$ at the point (x, y).

slope = ______

Find the equation of the tangent line to the ellipse at the point on the ellipse with x-coordinate 2 and y-coordinate above the x-axis.

$y =$ ______

Correct Answers:

- -[25*x/(9*y)]
- 3.72678-1.49071*(x-2)

20. **(1 point)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/3_Differentiation/3.7_The_Chain_Rule/3.7.1.pg

Given the following functions: $f(u) = u^{9/2}$ and $g(x) = x^{10} + 1$.

Find:

$f(g(x)) =$ ______

$f'(u) =$ ______

$f'(g(x)) =$ ______

$g'(x) =$ ______

$(f \circ g)'(x) =$ ______

Correct Answers:

- (x^10+1)^(9/2)
- 9/2*u^(9/2-1)
- 9/2*(x^10+1)^(9/2-1)
- 10*x^(10-1)
- 9/2*(x^10+1)^(9/2-1)*10*x^(10-1)

21. **(1 point)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/3_Differentiation/3.7_The_Chain_Rule/3.7.5.pg

Let $y = (x + \sin(x))^5$.

Find $g(x)$ and $f(x)$ so that $y = (f \circ g)(x)$, and compute the derivative using the Chain Rule.

$f(x) =$ ______

$g(x) =$ ______

$(f \circ g)' =$ ______

Correct Answers:

- x^5
- x+sin(x)
- 5*[1+1*cos(x)]*[1*x+1*sin(x)]^4

22. **(1 point)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/3_Differentiation/3.7_The_Chain_Rule/3.7.7.pg

Calculate $\frac{d}{dx}\cos(u)$ for the following choices of $u(x)$:

$u(x) = 9 - x^2$, $\frac{d}{dx}\cos(u(x)) =$ ______

$u(x) = x^{-5}$, $\frac{d}{dx}\cos(u(x)) =$ ______

$u(x) = \tan(x)$, $\frac{d}{dx}\cos(u(x)) =$ ______

Correct Answers:

- 2*x*sin(9-x**2)
- 5*sin(x**(-5))/x**(5+1)
- -sec(x)**2*sin(tan(x))

23. **(1 point)** Library/Utah/Calculus_I/set5_The_Derivative/1210s5p2.pg

Let

$$f(x) = \frac{x}{\cos x^2}.$$

$f'(x) =$ ______

Correct Answers:

- [cos(x^2)+2*x^2*sin(x^2)]/([cos(x^2)]^2)

24. **(1 point)** Library/Wiley/setAnton_Section_2.6/Question46.pg

Find the equation of the tangent line to the graph of $y(x) = 4\left(x - \frac{1}{x}\right)^4$ at $x = 2$.

Equation of the tangent line is $y =$ ______

Correct Answers:

- 67.5*x-114.75

25. **(1 point)** Library/UCSB/Stewart5_3_5/Stewart5_3_5_53.pg

Suppose that $F(x) = f(g(x))$ and $g(3) = 6, g'(3) = 4, f'(3) = 10$, and $f'(6) = 7$. Find $F'(3)$.

$F'(3) =$ ______

Correct Answers:

- 28

26. **(1 point)** Library/ma122DB/set5/s3_5_53.pg

Let $F(x) = f(x^5)$ and $G(x) = (f(x))^5$ and suppose that

$$a^4 = 12, \quad f(a) = 3, \quad f'(a) = 5, \quad f'(a^5) = 12$$

Find $F'(a)$ and $G'(a)$.

$F'(a) =$ _____
$G'(a) =$ _____
Correct Answers:

- 5*12*12
- 5*(3^4)*5

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27. **(1 point)** Library/ma122DB/set5/s3_5_55.pg
Let $F(x) = f(f(x))$ and $G(x) = (F(x))^2$ and suppose that

$$f(3) = 15, \quad f(15) = 3, \quad f'(15) = 8, \quad f'(3) = 7$$

Find $F'(3)$ and $G'(3)$.

$F'(3) =$ _____
$G'(3) =$ _____
Correct Answers:

- 8*7
- 2*3*8*7

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28. **(1 point)** Library/UVA-Stew5e/setUVA-Stew5e-C03S02-ProdQuotRules/3-2-31b.pg
Consider the functions $f(x)$ and $g(x)$, for which $f(0) = 4$, $g(0) = 5$, $f'(0) = 11$, and $g'(0) = -8$.

Find $h'(0)$ for the function $h(x) = \dfrac{f(x)}{g(x)}$.

$h'(0) =$ _____
Correct Answers:

- (5*11-4*-8)/(5^2)

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29. **(1 point)** Library/UVA-Stew5e/setUVA-Stew5e-C03S02-ProdQuotRules/3-2-34.pg
Consider the function $h(x)$, for which $h(4) = -3$ and $h'(4) = 7$.

Find $f'(4)$ for the function $f(x) = \dfrac{h(x)}{x}$.

$f'(4) =$ _____
Correct Answers:

- 7/4--3/(4^2)

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30. **(1 point)** Library/UVA-Stew5e/setUVA-Stew5e-C03S02-ProdQuotRules/3-2-31d.pg
Consider the function $f(x)$, for which $f(0) = 6$ and $f'(0) = -5$.

Find $h'(0)$ for the function $h(x) = \frac{1}{f(x)}$.

$h'(0) =$ _____
Correct Answers:

- -(-5)/(6^2)

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31. **(1 point)** Library/AlfredUniv/anton8e/chapter3/3.4/prob9.pg
Find $g'(3)$ given that $f(3) = -2$, $f'(3) = 4$, and $g(x) = \frac{2x+1}{f(x)}$.

Answer: _____
Correct Answers:

- -8

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32. **(1 point)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/3_Differentiation/3.3_Product_and_Quotient_Rules/3.3.23.pg

Compute the derivative:

$$\frac{d}{dx}\left(\frac{x^4-4}{x^2-5}\right)\Bigg|_{x=2}$$

The derivative is: _____
Correct Answers:

- -80/1

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33. **(1 point)** Library/Union/setDervProductQuotientRule/3-5-19.pg
Let f and g be functions such that

$$f(0) = 7, \quad g(0) = 9,$$

$$f'(0) = -11, \quad g'(0) = -5.$$

Find $h'(0)$ for the function $h(x) = g(x)f(x)$.

$h'(0) =$ _____
Correct Answers:

- -5*7+-11*9

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34. **(1 point)** Library/Rochester/setDerivatives2Formulas/d3.pg
Given that

$$\begin{aligned} f(x) &= x^5 h(x) \\ h(-1) &= 3 \\ h'(-1) &= 6, \end{aligned}$$

calculate $f'(-1)$. _____

[HINT: Use the product rule and the power rule.]
Correct Answers:

- 3*5*1+6*-1

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35. **(1 point)** Library/AlfredUniv/anton8e/chapter3/3.4/prob7.pg
Find $g'(4)$ given that $f(4) = -1$, $f'(4) = -1$, and $g(x) = \sqrt{x} f(x)$.

Answer: _____
Correct Answers:

- -2.25

36. (1 point) Library/Westmont/ActiveCalculus/Preview_2_3/preview_2_3_abc.pg

Let f and g be the functions defined by $f(t) = 4t^2$ and $g(t) = t^3 + 2t$.
Determine $f'(t)$ and $g'(t)$.
$f'(t) =$ ______
$g'(t) =$ ______

Let $p(t) = 4t^2(t^3 + 2t)$ and observe that $p(t) = f(t) \cdot g(t)$. Rewrite the formula for p by distributing the $4t^2$ term. Then, compute $p'(t)$ using the sum and constant multiple rules.
$p'(t) =$ ______

True or False: $p'(t) = f'(t) \cdot g'(t)$ [?/True/False]

Correct Answers:

- `4*2*t`
- `3*t^2+2`
- `4*5*t^4+8*3*t^2`
- `False`

37. (1 point) Library/Union/setDervProductQuotientRule/s2_2_13.pg

Let $f(t) = \left(t^2 + 4t + 2\right)\left(2t^2 + 6\right)$. Find $f'(t)$.
$f'(t) =$ ______
Find $f'(4)$.
$f'(4) =$ ______

Correct Answers:

- `(2*t+4)*(2*t^2+6)+(t^2+4*t+2)*2*2*t`
- `1000`

38. (1 point) Library/UCSB/Stewart5_3_2/Stewart5_3_2_10.pg

Differentiate:

$$Y(u) = (u^{-2} + u^{-3})(u^5 + 5u^2)$$

$Y'(u) =$ ______

Correct Answers:

- `[-2*u^(-3)-3*u^(-4)]*(u^5+5*u^2)+[u^(-2)+u^(-3)]*(5*u^4+2*5*u)`

39. (1 point) Library/UCSB/Stewart5_3_4/Stewart5_3_4_28.pg

If $f(x) = \sqrt{x}\sin x$, find $f'(x)$.

$f'(x) =$ ______

Correct Answers:

- `x^(1/2)*cos(x)+1/2*x^(-1/2)*sin(x)`

40. (1 point) Library/Union/setDervTrigonometric/s2_4_25.pg

Let $f(x) = \dfrac{2\tan(x)}{x}$. Find the following:

1. $f'(x)$ = ______
2. $f'(1)$ = ______

Correct Answers:

- `(2*[sec(x)]^2*x-2*tan(x))/(x^2)`
- `3.73622`

41. (1 point) Library/UVA-Stew5e/setUVA-Stew5e-C03S04-DerivsTrig/3-4-25.pg

Find the equation of the line that is tangent to the curve

$$y = 5x\cos x$$

at the point $(\pi, -5\pi)$.

The equation of this tangent line can be written in the form $y = mx + b$ where

$m =$ ______

and $b =$ ______

Correct Answers:

- `-5`
- `0`

42. (1 point) Library/UVA-Stew5e/setUVA-Stew5e-C03S04-DerivsTrig/3-4-24.pg

Find the equation of the tangent line to the curve

$$y = \frac{1}{2\sin x + 2\cos x}$$

at the point $(0, 1/2)$.

The equation of this tangent line can be written in the form $y = mx + b$ where
$m =$ ______
and $b =$ ______

Correct Answers:

- `-0.5`
- `0.5`

43. (1 point) Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/3_Differentiation/3.9_Derivatives_of_General_Exponential_and_Logarithmic_Functions/3.9.45.pg

Find the derivative by one of following two methods: rewrite using $f(x) = e^{\ln f(x)}$ or use logarithmic differentiation.

$y = x^{2x}$
$y' =$ ______

Correct Answers:

- `x^(2*x)*[2+2*ln(x)]`

44. (1 point) Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/3_Differentiation/3.9_Derivatives_of_General_Exponential_and_Logarithmic_Functions/3.9.49.pg

Find the derivative of $y = x^{3^x}$.
$dy/dx =$ ______

Correct Answers:

- `x^(3^x)*[1.09861*3^x*ln(x)+3^x/x]`

45. **(1 point)** Library/Wiley/setAnton_Section_3.3/Question32.pg
Find dy/dx using the method of logarithmic differentiation when $y = x^{8\sin(x)}$.
$dy/dx =$ ______________
Correct Answers:

- 8*x^[8*sin(x)]*[cos(x)*ln(x)+[sin(x)]/x]

46. **(1 point)** Library/Wiley/setAnton_Section_3.3/Question34.pg
Find dy/dx using the method of logarithmic differentiation when $y = \left(5+5x^2\right)^{\ln(x)}$.
$dy/dx =$ ______________
Correct Answers:

- (5+5*x^2)^[ln(x)]*[10*x*ln(x)/(5+5*x^2)+[ln(5+5*x^2)]/x]

47. **(1 point)** Library/ASU-topics/setDerivativeFunction/3-3-05.pg
Suppose that

$$f(x+h) - f(x) = -2hx^2 - 6hx + 3h^2x - 2h^2 - 5h^3.$$

Find $f'(x)$.

$f'(x) =$ __________
Correct Answers:

- -2*x**2 + -6*x

48. **(1 point)** setFinal1475/Rogawski_Calculus3_Differentiation3.11_Related_Rates3.11.3.pg

The radius of a circular oil slick expands at a rate of 6 m/min.
(a) How fast is the area of the oil slick increasing when the radius is 26 m?
$\frac{dA}{dt} =$ ________ m^2/min
(b) How fast is the radius increasing when the area is 750 m^2?
$\frac{dr}{dt} =$ ________ m/min
Correct Answers:

- 980.176907920015
- 6

49. **(1 point)** setFinal1475/04-06-Related-rates-02.pg
Suppose that water is pouring into a swimming pool in the shape of a right circular cylinder at a constant rate of 3 cubic feet per minute. If the pool has radius 4 feet and height 9 feet, what is the rate of change of the height of the water in the pool when the depth of the water in the pool is 7 feet?
The volume of a right circular cylinder is given by

$$V = \pi r^2 h,$$

where r is the radius of the base and h is the height of the cylinder.

__________ ft/min.
Correct Answers:

- 3/(pi*4^2)

50. **(1 point)** setFinal1475/Bucket06-Related-rates-03.pg
A potter forms a piece of clay into a right circular cylinder. As she rolls it, the height h of the cylinder increases and the radius r decreases. Assume that no clay is lost in the process. Suppose the height of the cylinder is increasing by 0.5 centimeters per second. What is the rate at which the radius is changing when the radius is 6 centimeters and the height is 9 centimeters?
The volume of a right circular cylinder is given by

$$V = \pi r^2 h,$$

where r is the radius of the base and h is the height of the cylinder.

__________ cm/s.
Correct Answers:

- -(6*0.5)/(2*9)

51. **(1 point)** setFinal1475/Bucket06ApplicationsRelatedRatess2_8_21.pg
Gravel is being dumped from a conveyor belt at a rate of 20 $\mathrm{ft}^3/\mathrm{min}$. It forms a pile in the shape of a right circular cone whose base diameter and height are always the same. How fast is the height of the pile increasing when the pile is 10 ft high?
The volume of a circular cone is

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

where r if the radius of the base and h is the height of the cone.

The height is increasing at ________ ft/min.
Correct Answers:

- 0.254648

52. **(1 point)** setFinal1475/Bucket06ApplicationsRelatedRatesan3_7_25.pg
A conical water tank with vertex down has a radius of 11 feet at the top and is 23 feet high. If water flows into the tank at a rate of 30 $\mathrm{ft}^3/\mathrm{min}$, how fast is the depth of the water increasing when the water is 16 feet deep?
The volume of a circular cone is

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

where r if the radius of the base and h is the height of the cone.

The depth of the water is increasing at __________ ft/min.
Correct Answers:

- 0.16308

53. **(1 point)** `setFinal1475/Bucket06Applications3.11_Related_Rates3.11.5.pg`

1. Assume that the radius r of a sphere is expanding at a rate of 14 in/ min The volume of a sphere is $V = \frac{4}{3}\pi r^3$.
Determine the rate at which the **volume is changing** with respect to time when $r = 15$ in.
The volume is changing at a rate of ________ in^3/ min.

2. Assume that the volume V of a sphere is expanding at a rate of 500 in^3/ min The volume of a sphere is $V = \frac{4}{3}\pi r^3$.
Determine the rate at which the **radius is changing** with respect to time when $r = 4$ in.
The radius is changing at a rate of ________ in/ min.
Correct Answers:

- `39584.1`
- `2.4868`

54. **(1 point)** `setFinal1475/Bucket06ApplicationsRelatedRatesImplicitDerivatives5-5-14.pg`
1. The radius of a spherical balloon is increasing at a rate of 3 centimeters per minute. How fast is the surface area changing when the radius is 14 centimeters?
Hint: The surface area is $S = 4\pi r^2$.

Rate of change of **surface area** = ________ cm^2/min

2. The surface area of a spherical balloon is increasing at a rate of 32 centimeters per minute. How fast is the radius changing when the radius is 14 centimeters?

Rate of change of **radius** = ________ cm/min

Correct Answers:

- `1055.57513160624`
- `0.0909456817667913`

55. **(1 point)** `Library/Michigan/Chap4Sec5/Q17.pg`
If you have 200 meters of fencing and want to enclose a rectangular area up against a long, straight wall, what is the largest area you can enclose?
Area = ____________ (include **units**)
Correct Answers:

- `5000 m^2`

56. **(1 point)** `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.7_Applied_Optimization/4.7.23.pg`

A landscape architect wished to enclose a rectangular garden on one side by a brick wall costing \$30/ft and on the other three sides by a metal fence costing \$20/ft. If the area of the garden is 162 square feet, find the dimensions of the garden that minimize the cost.
Length of side with bricks $x =$________
Length of adjacent side $y =$ ________
Correct Answers:

- `sqrt(2*20*162/(20+30))`
- `(20+30)/(2*20)*sqrt(2*20*162/(20+30))`

57. **(1 point)** `setFinal1475/Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.7_Applied_Optimization/4.7.4.pg`

Find a positive number x such that the sum of $36x$ and $\frac{1}{x}$is as small as possible.
$x =$ ________

Correct Answers:

- `0.166666666666667`

58. **(1 point)** `Library/Rochester/setDerivatives10_5Optim/S04.07.Optimization.PTP06.pg`
If 1300 square centimeters of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

Volume = ____________ (include **units**)
Correct Answers:

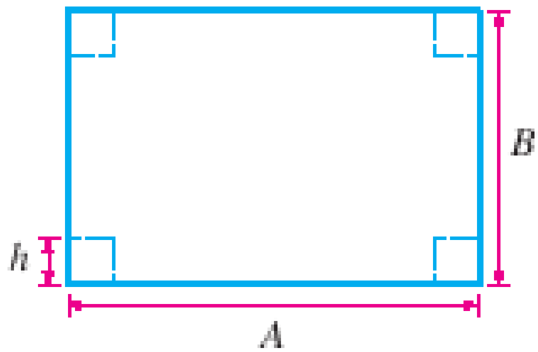
- `4510.28 cm^3`

59. **(1 point)** `Library/Rochester/setDerivatives10_5Optim/S04.07.Optimization.PTP07.pg`
A box with an open top has vertical sides, a square bottom, and a volume of 4 cubic meters. If the box has the least possible surface area, find its dimensions.
Height = ________ (include **units**)
Length of base = ________ (include **units**)
Correct Answers:

- `1 m`
- `2 m`

60. **(1 point)** `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.7_Applied_Optimization/4.7.47.pg`

A box (with no top) is to be constructed from a piece of cardboard of sides A and B by cutting out squares of length h from the corners and folding up the sides as in the figure below:



Suppose that the box height is $h = 5$ in. and that it is constructed using 153 in.^{2} of cardboard (i.e., $AB = 153$). Which values A and B maximize the volume?
$A =$ ________ in.
$B =$ ________ in.

Correct Answers:

- `12.3693`
- `12.3693`

61. (1 point) `Library/UVA-Stew5e/setUVA-Stew5e-C04S07-Optimization/4-7-29.pg`
The top and bottom margins of a poster are 6 cm and the side margins are each 2 cm. If the area of printed material on the poster is fixed at 388 square centimeters, find the dimensions of the poster with the smallest area.
Width = ______ Height = ______
Correct Answers:

- `15.3724814061547`
- `46.117444218464`

62. (1 point) `Library/Wiley/setAnton_Section_2.2/Question7.pg`
Given that $f(9) = 9$ and $f'(9) = 1$, find an equation for the tangent line to the graph of $y = f(x)$ at $x = 9$.
$y =$ ______
Correct Answers:

- `1*x+0`

63. (1 point) `setFinal1475/Stewart5_3_11/Stewart5_3_11_8.pg`

(a) Find the equation of the tangent line to $f(x) = \sqrt[3]{x}$ at $x = 125$.
$y =$ ____________
(b) Use your answer to part (a) to estimate the value of $\sqrt[3]{124.6}$.
$\sqrt[3]{124.6} \approx$ ____________
Correct Answers:

- `x/(3*5**2) + 2*5/3`
- `-0.4/(3*5**2) + 5`

64. (1 point) `setFinal1475/Rogawski_Calculus_Early_Transcendentals_Second_Edition4_Applications_of_the_Derivative4.1_Linear_Approximation_and_Applications4.1.49.pg`

(a) Find the equation of the tangent line to $f(x) = (25+x)^{-1/2}$ at $x = 0$
$y =$ ________
(b) Use your answer to part (a) to estimate the value of $(24.8)^{-1/2}$.
$(24.8)^{-1/2} \approx$ ________
Correct Answers:

- `0.2+(-0.004)*(x-0)`
- `0.2008`

65. (1 point) `setFinal1475/4_Applications_of_the_Derivative4.1_Linear_Approximation_and_Applications4.1.51.pg`

(a) Find the equation of the tangent line to $f(x) = (81+4x^2)^{-1/2}$ at $x = 0$.
$y =$ ________
(b) Use your answer to (a) to estimate the value of $80.6^{-1/2}$.
$80.6^{-1/2} \approx$ ________
Correct Answers:

- `0.111111`
- `0.111111`

66. (1 point) `setFinal1475/Bucket08ApplicationsLinearizationStewart5_3_11_11.pg`

(a) Find the equation of the tangent line to $f(x) = \sqrt[6]{1-x}$ at $x = 0$.
$y =$ ________
(b) Use your answer to part (a) to estimate the value of $\sqrt[6]{0.7}$
$\sqrt[6]{0.7} \approx$ ________
Correct Answers:

- `1-x/6`
- `1-0.3/6`

67. (1 point) `Library/Michigan/Chap2Sec2/Q11.pg`
Suppose that $f(x)$ is a function with $f(120) = 40$ and $f'(120) = 6$. Estimate $f(116.5)$.
$f(116.5) =$ ______________
Correct Answers:

- `19`

68. (1 point) `Library/UVA-Stew5e/setUVA-Stew5e-C03S11-LinApprox/3-11-23.pg`
Let $y = (x^2+4)^5$.
Find the differential dy when $x = 3$ and $dx = 0.3$ ________
Find the differential dy when $x = 3$ and $dx = 0.05$ ________
Correct Answers:

- `257049`
- `42841.5`

69. (1 point) `Library/UVA-Stew5e/setUVA-Stew5e-C03S11-LinApprox/3-11-24.pg`
Let $y = \sqrt{7-x}$.
Find the differential dy when $x = 1$ and $dx = 0.2$ ________
Find the differential dy when $x = 1$ and $dx = 0.05$ ________
Correct Answers:

- `-0.0408248290463863`
- `-0.0102062072615966`

70. **(1 point)** `Library/UVA-Stew5e/setUVA-Stew5e-C03S11-LinApprox/3-11-22.pg`

Let $y = e^{x/1}$.

Find the differential dy when $x = 3$ and $dx = 0.4$ ______

Find the differential dy when $x = 3$ and $dx = 0.04$ ______

Correct Answers:

- `8.03421476927507`
- `0.803421476927507`

71. **(1 point)** `Library/UVA-Stew5e/setUVA-Stew5e-C04S05-CurveSketch/4-5-07.pg`

Suppose that

$$f(x) = \frac{4x-6}{x+6}.$$

(A) Find all critical values of f. If there are no critical values, enter *None* . If there are more than one, enter them separated by commas.

Critical value(s) = ______

(B) Use **interval notation** to indicate where $f(x)$ is increasing. If it is increasing on more than one interval, enter the union of all intervals where $f(x)$ is increasing.

Increasing: ______

(C) Use **interval notation** to indicate where $f(x)$ is decreasing. If it is decreasing on more than one interval, enter the union of all intervals where $f(x)$ is decreasing.

Decreasing: ______

(D) Find the x-coordinates of all local maxima of f. If there are no local maxima, enter *None* . If there are more than one, enter them separated by commas.

Local maxima at x = ______

(E) Find the x-coordinates of all local minima of f. If there are no local minima, enter *None* . If there are more than one, enter them separated by commas.

Local minima at x = ______

(F) Use **interval notation** to indicate where $f(x)$ is concave up.

Concave up: ______

(G) Use **interval notation** to indicate where $f(x)$ is concave down.

Concave down: ______

(H) Find all inflection points of f. If there are no inflection points, enter *None* . If there are more than one, enter them separated by commas.

Inflection point(s) at x = ______

(I) Find all horizontal asymptotes of f. If there are no horizontal asymptotes, enter *None* . If there are more than one, enter them separated by commas.

Horizontal asymptote(s): y = ______

(J) Find all vertical asymptotes of f. If there are no vertical asymptotes, enter *None* . If there are more than one, enter them separated by commas.

Vertical asymptote(s): x = ______

(K) Use all of the preceding information to sketch a graph of f. When you're finished, enter a **1** in the box below.

Graph Complete: ______

Correct Answers:

- `None`
- `(-infinity,-6) U (-6,infinity)`
- `{}`
- `None`
- `None`
- `(-infinity,-6)`
- `(-6,infinity)`
- `None`
- `4`
- `-6`
- `1`

72. **(1 point)** `Library/ASU-topics/setSecondDerivative/4-4-72.pg`

Suppose that

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

(A) List all the critical values of $f(x)$. Note: If there are no critical values, enter 'NONE'.

______

(B) Use interval notation to indicate where $f(x)$ is increasing.

Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol. If there is no interval, enter 'NONE'.

Increasing: ______

(C) Use interval notation to indicate where $f(x)$ is decreasing.

Decreasing: ______

(D) List the x values of all local maxima of $f(x)$. If there are no local maxima, enter 'NONE'.

x values of local maximums = ______

(E) List the x values of all local minima of $f(x)$. If there are no local minima, enter 'NONE'.

x values of local minimums = ______

(F) Use interval notation to indicate where $f(x)$ is concave up.

Concave up: ______

(G) Use interval notation to indicate where $f(x)$ is concave down.

Concave down: ______

(H) List the x values of all the inflection points of f. If there are no inflection points, enter 'NONE'.

x values of inflection points = ______

(I) Find all horizontal asymptotes of f, and list the y values below. If there are no horizontal asymptotes, enter 'NONE'
y values of horizontal asymptotes = ______
(J) Find all vertical asymptotes of f, and list the x values below. If there are no vertical asymptotes, enter 'NONE'
x values of vertical asymptotes = ______
(K) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.
Graph complete: ______
Correct Answers:

- 0
- (0,infinity)
- (-infinity,0)
- none
- 0
- (-3.46410161513775,3.46410161513775)
- (-infinity,-3.46410161513775) U (3.46410161513775,infinity)
- -3.46410161513775, 3.46410161513775
- 3
- none
- 1

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73. **(1 point)** setPFinal1475Bucket09ApplicationsShape/S04.05.CurveSketching.PTP03.pg
Please answer the following questions about the function

$$f(x) = \frac{5}{x^2-4}.$$

Instructions: If you are asked to find a function, enter a function. If you are asked to find x- or y-values, enter either a number, a list of numbers separated by commas, or *None* if there aren't any solutions. Use **interval notation** if you are asked to find an interval or union of intervals, and enter { } if the interval is empty.

Calculate the first derivative of f. Find the critical numbers of f, where it is increasing and decreasing, and its local extrema.
(a) $f'(x) =$ ____________
(b) Critical numbers $x =$ ____________
(c) Increasing on the interval ____________
(d) Decreasing on the interval ____________
(e) Local maxima $x =$ ____________
(f) Local minima $x =$ ____________

Correct Answers:

- -(10 * x) / ((x**2 - 4)**2)
- 0
- (-infinity,-2) U (-2,0)
- (0,2) U (2,infinity)
- 0
- None

---

74. **(1 point)** Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.3_The_Mean_Value_Theorem_and_Monotonicity/4.3.30.pg

Find the critical points and determine if the function is increasing or decreasing on the given intervals.
$y = 6x^4 + 4x^3$
Left critical point: $c_1 =$ ___
Right critical point: $c_2 =$ ___
The function is:
$\boxed{?}$ on $(-\infty, c_1)$.
$\boxed{?}$ on (c_1, c_2).
$\boxed{?}$ on (c_2, ∞).

Correct Answers:

- -0.5
- 0
- Decreasing
- Increasing
- Increasing

---

75. **(1 point)** Library/Michigan/Chap4Sec1/Q09.pg
For the function $f(x) = -2x^3 + 24x + 3$, find all intervals where the function is increasing: f is increasing on ____________
(Give your answer as an interval or a list of intervals, e.g., **(-infinity,8]** *or* **(1,5),(7,10)** *.)*
Similarly, find all intervals where the function is decreasing: f is decreasing on ____________
(Give your answer as an interval or a list of intervals, e.g., **(-infinity,8]** *or* **(1,5),(7,10)** *.)*
Finally, find all critical points in the graph of $f(x)$
critical points: $x =$ ____________
(Enter your x-values as a comma-separated list, or **none** *if there are no critical points.)*
Correct Answers:

- (-2,2)
- (-infinity,-2), (2,infinity)
- -2, 2

---

76. **(1 point)** Library/ASU-topics/setFirstDerivative/4-2-31.pg
Let

$$f(x) = 5 + 2x - x^3.$$

(A) Use interval notation to indicate where $f(x)$ is increasing.
Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.
Increasing: ____________
(B) Use interval notation to indicate where $f(x)$ is decreasing.
Decreasing: ____________
(C) List the x values of all local maxima of f. If there are no local maxima, enter 'NONE'.
x values of local maximums = ____________

(D) List the x values of all local minima of f. If there are no local minima, enter 'NONE'.
x values of local minimums = ______
Correct Answers:

- `(-0.816496580927726,0.816496580927726)`
- `(-infinity,-0.816496580927726) U (0.816496580927726,infinity)`
- `0.816496580927726`
- `-0.816496580927726`

---

77. (1 point) `Library/ASU-topics/setSecondDerivative/4-4-50.pg`
Suppose that $f(x) = x^4 - 5x^3$.
(A) List all the critical values of $f(x)$. Note: If there are no critical values, enter 'NONE'.

______

(B) Use interval notation to indicate where $f(x)$ is increasing.
Note: Use 'INF' for ∞, '-INF' for $-\infty$, and use 'U' for the union symbol.
Increasing: ______
(C) Use interval notation to indicate where $f(x)$ is decreasing.
Decreasing: ______
(D) List the x values of all local maxima of $f(x)$. If there are no local maxima, enter 'NONE'.
x values of local maximums = ______
(E) List the x values of all local minima of $f(x)$. If there are no local minima, enter 'NONE'.
x values of local minimums = ______ (F) Use interval notation to indicate where $f(x)$ is concave up.
Concave up: ______
(G) Use interval notation to indicate where $f(x)$ is concave down.
Concave down: ______
(H) List the x values of all the inflection points of f. If there are no inflection points, enter 'NONE'.
x values of inflection points = ______
(I) Use all of the preceding information to sketch a graph of f. When you're finished, enter a "1" in the box below.

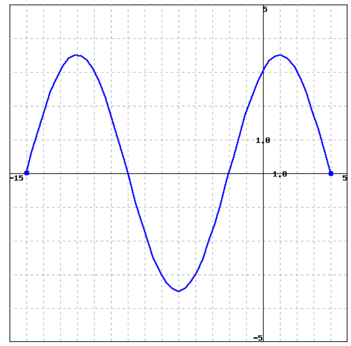
______

Correct Answers:

- `0, 3.75`
- `(3.75,infinity)`
- `(-infinity,3.75)`
- `none`
- `3.75`
- `(-infinity,0) U (2.5,infinity)`
- `(0,2.5)`
- `0, 2.5`
- `1`

---

78. (1 point) `Library/Valdosta/APEX_Calculus/2.1/APEX_2.1_30.pg`
Using the graph of $g(x)$ below, answer the following questions.



a) Where is $g(x) > 0$? ______ (Enter an interval)
b) Where is $g(x) < 0$? ______ (Enter an interval)
c) Where is $g(x) = 0$? ______ (Enter a list of values, separated by commas)
d) Where is $g'(x) > 0$? ______ (Enter an interval)
e) Where is $g'(x) < 0$? ______ (Enter an interval)
f) Where is $g'(x) = 0$? ______ (Enter a list of values, separated by commas)
NOTE: When using interval notation in WeBWorK, remember that:
You use 'INF' for ∞ and '-INF' for $-\infty$.
And use 'U' for the union symbol.
Correct Answers:

- `(-14,-8) U (-2,4)`
- `(-8,-2)`
- `-14, -8, -2, 4`
- `(-14,-11) U (-5,1)`
- `(-11,-5) U (1,4)`
- `-11, -5, 1`

---

79. (1 point) `Library/UVA-Stew5e/setUVA-Stew5e-C05S04-IndefInts/5-4-08.pg`
Evaluate the indefinite integral:

$$\int x(5+4x^6)\,dx = \_\_\_\_\_\_ + C.$$

Correct Answers:

- `(5/2)*x**2 + (4/(6+2))*x**(6+2)`

---

80. (1 point) `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.9_Antiderivatives/4.9.27.pg`

Evaluate the following indefinite integral.
$$\int \frac{5}{t^7}\,dt = \_\_\_\_\_\_ + C$$
Correct Answers:

- `-[5/(6*t^6)]`

---

81. (1 point) `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.9_Antiderivatives/4.9.17.pg`

Evaluate the following indefinite integral $\int x^{-5/8}\,dx =$

__________ $+C$

Correct Answers:

- `x^(0.375)/0.375`

---

82. (1 point) `Library/UVA-Stew5e/setUVA-Stew5e-C05S04-IndefInts/5-4-05b.pg`

Evaluate the indefinite integral:

$$\int \frac{du}{3\sqrt{u}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ + C.$$

Correct Answers:

- `(2/3)*u**(1/2)`

---

83. (1 point) `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.9_Antiderivatives/4.9.33.pg`

Evaluate the following indefinite integral $\int 7\sin(x) - 5\cos(x)\,dx =$ __________ $+C$

Correct Answers:

- `-7*cos(x)-5*sin(x)`

---

84. (1 point) `Library/UVA-Stew5e/setUVA-Stew5e-C05S04-IndefInts/5-4-05f.pg`

Evaluate the indefinite integral:

$$\int \frac{2-7xe^x}{x}\,dx = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ + C.$$

Correct Answers:

- `-7*exp(x) + 2*ln(abs(x))`

---

85. (1 point) `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.9_Antiderivatives/4.9.66.pg`

First find f' and then find f.
$f''(x) = 9x^2 - 10x^3 - 9x - 6$,
$f'(1) = -2$,
$f(1) = 2$.
$f'(x) =$ ____________________
$f(x) =$ ____________________

Correct Answers:

- `3*x^3-5/2*x^4-9/2*x^2-6*x+8`
- `3/4*x^4-1/2*x^5-3/2*x^3-3*x^2+8*x-7/4`

---

86. (1 point) `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/4_Applications_of_the_Derivative/4.9_Antiderivatives/4.9.68.pg`

Given that $f''(x) = \cos(x)$, $f'(\pi/2) = 3$ and $f(\pi/2) = 11$ find:

$f'(x) =$ __________

$f(x) =$ __________

Correct Answers:

- `sin(x)+2`
- `-[cos(x)]+2*x+11-2*pi/2`

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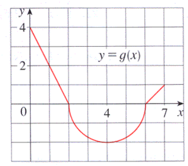
87. (1 point) `Library/UCSB/Stewart5_5_2/Stewart5_5_2_34/Stewart5_5_2_34.pg`

Consider the graph of the function $g(x)$:



The graph from $x = 2$ to $x = 6$ is a semicircle. Evaluate the following integrals by interpreting them in terms of areas:

(a) $\int_0^2 g(x)\,dx =$ __________

(b) $\int_2^6 g(x)\,dx =$ __________

(c) $\int_0^7 g(x)\,dx =$ __________

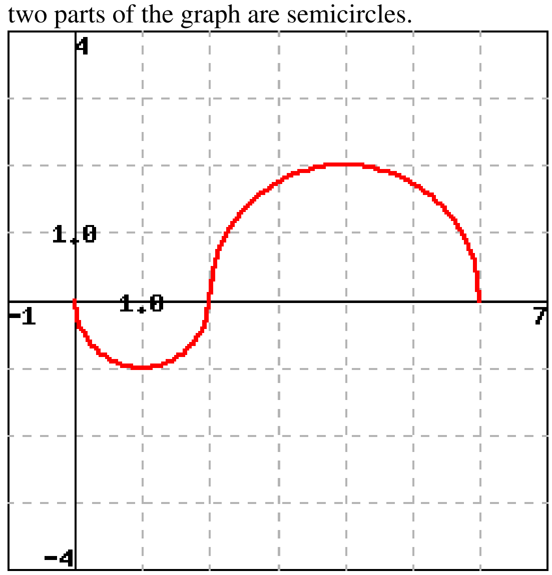
Correct Answers:

- `4`
- `-2*pi`
- `4.5-2*pi`

---

88. (1 point) `Library/WHFreeman/Rogawski_Calculus_Early_Transcendentals_Second_Edition/5_The_Integral/5.2_The_Definite_Integral/5.2.13.pg`

Evaluate the integrals for $f(x)$ shown in the figure below. The two parts of the graph are semicircles.



a) $\int_0^2 5f(x)\,dx =$ ___

b) $\int_0^6 4f(x)\,dx =$ ___

c) $\int_1^4 3f(x)\,dx =$ ___
d) $\int_1^6 \mid 2f(x) \mid \, dx =$ ___
Correct Answers:

- `-7.85398`
- `18.8496`
- `7.06858`
- `14.1372`

---

89. **(1 point)** `Library/Union/setIntDefinite/osu_in_3_3.pg`
Evaluate the definite integral.
$\int_4^5 \frac{4x^2+2}{x^2}\,dx =$ ____________________
Correct Answers:

- `4.1`

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90. **(1 point)** `Library/Michigan/Chap5Sec2/Q13.pg`
Find area of the region under the curve $y = 4x^3 - 7$ and above the x-axis, for $4 \le x \le 7$.
area = ______________
Correct Answers:

- `2124`

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91. **(1 point)** `setFinal1475/Calc1APEX_02_01_Deriv_defLimit_04.pg`

Part 1: The derivative at a specific point
Use the definition of the derviative to compute the derivative of $f(x) = \frac{9}{x}$ at the specific point $x = 2$. Evaluate the limit by using algebra to simplify the difference quotient (in first answer box) and then evaluating the limit (in the second answer box).

$$f'(2) = \lim_{h\to 0}\left(\frac{f(2+h)-f(2)}{h}\right) = \lim_{h\to 0}\left(\underline{\qquad\qquad} \right) = \underline{\quad}.$$

Part 2: The derivative function
Use the definition of the derivative to compute the derivative of the function $f(x) = \frac{9}{x}$ at an arbitrary point x. Evaluate the limit by using algebra to simplify the difference quotient (in first answer box) and then evaluating the limit (in the second answer box).

$$f'(x) = \lim_{h\to 0}\left(\frac{f(x+h)-f(x)}{h}\right) = \lim_{h\to 0}\left(\underline{\qquad\qquad} \right) = \underline{\quad}.$$

Part 3: The tangent line
Now let's calculate the tangent line to the function $f(x) = \frac{9}{x}$ at $x = 4$.

a. By using $f'(x)$ from part 2, the slope of the tangent line to f at $x = 4$ is $f'(4) =$ ____.

b. The tangent line to f at $x = 4$ passes through the point $(4, f(4)) =$ _____ on the graph of f. (Enter a point in the form (2, 3) including the parentheses.)

c. An equation for the tangent line to f at $x = 4$ is $y =$ ________.

Correct Answers:

- `-9/[2*(2+h)]`
- `-1*9/(2^2)`
- `-9/[x*(x+h)]`
- `-9/(x^2)`
- `-9/(4^2)`
- `(4,2.25)`
- `2.25+-0.5625*(x-4)`

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92. **(1 point)** `setFinal1475/Calc1APEX_02_01_Deriv_defLimit_03.pg`

Part 1: The derivative at a specific point
Use the definition of the derviative to compute the derivative of $f(x) = 1 - 9x^2$ at the specific point $x = 2$. Evaluate the limit by using algebra to simplify the difference quotient (in first answer box) and then evaluating the limit (in the second answer box).

$$f'(2) = \lim_{h\to 0}\left(\frac{f(2+h)-f(2)}{h}\right) = \lim_{h\to 0}\left(\underline{\qquad\qquad} \right) = \underline{\quad}.$$

Part 2: The derivative function
Use the definition of the derivative to compute the derivative of the function $f(x) = 1 - 9x^2$ at an arbitrary point x. Evaluate the limit by using algebra to simplify the difference quotient (in first answer box) and then evaluating the limit (in the second answer box).

$$f'(x) = \lim_{h\to 0}\left(\frac{f(x+h)-f(x)}{h}\right) = \lim_{h\to 0}\left(\underline{\qquad\qquad} \right) = \underline{\quad}.$$

Part 3: The tangent line
Now let's calculate the tangent line to the function $f(x) = 1 - 9x^2$ at $x = 4$.

a. By using $f'(x)$ from part 2, the slope of the tangent line to f at $x = 4$ is $f'(4) =$ ____.

b. The tangent line to f at $x = 4$ passes through the point $(4, f(4)) =$ _____ on the graph of f. (Enter a point in the form (2, 3) including the parentheses.)

c. An equation for the tangent line to f at $x = 4$ is $y =$ ________.

Correct Answers:

- `(-36)-9*h`
- `-2*2*9`
- `(-18)*x-9*h`
- `-2*x*9`
- `-2*4*9`
- `(4,-143)`
- `-143+-72*(x-4)`

- BEF

93. **(1 point)** `setFinal1475/Calc1APEX_02_01_Deriv_defLimit_02.pg`

Part 1: Limit of a difference quotient

Suppose $f(x) = \dfrac{6}{x-2}$. Evaluate the limit by using algebra to simplify the difference quotient (in first answer box) and then evaluating the limit (in the second answer box).

$$\lim_{h\to 0}\left(\frac{f(4+h)-f(4)}{h}\right) = \lim_{h\to 0}\left(\underline{\hspace{3cm}}\right) = \underline{\hspace{1cm}}.$$

Part 2: Interpreting the limit of a difference quotient

The limit of the difference quotient, -1.5, from Part 1 above is (select all that apply).

- A. the slope of the secant line to the graph of $y = f(x)$ at $x = 4$.
- B. $f'(4)$
- C. the average rate of change of f at $x = 4$.
- D. $f(4)$.
- E. the instantaneous rate of change of f at $x = 4$.
- F. the slope of the tangent line to the graph of $y = f(x)$ at $x = 4$.

Correct Answers:

- `(-6)/[2*(4+h-2)]`
- `-1*6/[(4-2)^2]`

94. **(1 point)** `setFinal1475/Calc1APEX_02_01_Deriv_defLimit_01.pg`

Part 1: Limit of a difference quotient

Suppose $f(x) = 3x^2 + 8x - 4$. Evaluate the limit by using algebra to simplify the difference quotient (in first answer box) and then evaluating the limit (in the second answer box).

$$\lim_{h\to 0}\left(\frac{f(-2+h)-f(-2)}{h}\right) = \lim_{h\to 0}\left(\underline{\hspace{3cm}}\right) = \underline{\hspace{1cm}}.$$

Part 2: Interpreting the limit of a difference quotient

The limit of the difference quotient, -4, from Part 1 above is (select all that apply).

- A. $f'(-2)$
- B. $f(-2)$.
- C. the slope of the tangent line to the graph of $y = f(x)$ at $x = -2$.
- D. the average rate of change of f at $x = -2$.
- E. the instantaneous rate of change of f at $x = -2$.
- F. the slope of the secant line to the graph of $y = f(x)$ at $x = -2$.

Correct Answers:

- `(-12)+3*h+8`
- `2*3*-2+8`
- `ACE`