07-21-19
07-23-19
7-29-19
7-31-19

Student: ____________________	**Instructor:** Alfredo Alvarez	**Assignment:**
Date: ____________________	**Course:** 2413 Cal I	CAL2413ANSWERSI105FIESTABB

1. For the position function $s(t) = -16t^2 + 107t$, complete the following table with the appropriate average velocities. Then make a conjecture about the value of the instantaneous velocity at $t = 1$.

Time Interval	[1, 2]	[1, 1.5]	[1, 1.1]	[1, 1.01]	[1, 1.001]
Average Velocity	____	____	____	____	____

Complete the following table.

Time Interval	[1, 2]	[1, 1.5]	[1, 1.1]	[1, 1.01]	[1, 1.001]
Average Velocity					

(Type exact answers. Type integers or decimals.)

The value of the instantaneous velocity at t = 1 is ______.
(Round to the nearest integer as needed.)

use a graphing Calculator

Answers 59
67
73.4
74.84
74.984
75

ID: 2.1.17

$$\frac{f(2)-f(1)}{(2)-(1)} =$$

$$\frac{(-16(2)^2+107(2))-(-16(1)^2+107(1))}{(2)-(1)} =$$

$$\frac{(-16(4)+107(2))-(-16(1)+107(1))}{2-1} =$$

$$\frac{(-64+214)-(-16+107)}{2-1} =$$

$$\frac{(150)-(91)}{2-1} =$$

$$\frac{150-91}{2-1} =$$

$$\frac{59}{1} =$$

$$59 =$$

#1 Part 2

$$\boxed{f(t) = -16t^2 + 107t}$$

$$\frac{f(1.5) - f(1)}{(1.5) - (1)} = \boxed{67}$$

$$\frac{f(1.1) - f(1)}{(1.1) - (1)} = \boxed{73.4}$$

$$\frac{f(1.01) - f(1)}{(1.01) - (1)} = \boxed{74.84}$$

$$\frac{f(1.001) - f(1)}{(1.001) - (1)} = \boxed{74.984}$$

instaneous velocity at $x=1$ is $\boxed{75}$

2.

Let $f(x) = \frac{x^2-9}{x+3}$. **(a)** Calculate f(x) for each value of x in the following table. **(b)** Make a conjecture about the value of

$$\lim_{x \to -3} \frac{x^2-9}{x+3}.$$

(a) Calculate f(x) for each value of x in the following table.

x	−2.9	−2.99	−2.999	−2.9999
$f(x) = \frac{x^2-9}{x+3}$				
x	−3.1	−3.01	−3.001	−3.0001
$f(x) = \frac{x^2-9}{x+3}$				

(Type an integer or decimal rounded to four decimal places as needed.)

(b) Make a conjecture about the value of $\lim_{x \to -3} \frac{x^2-9}{x+3}$.

Use a graphing calculator

$\lim_{x \to -3} \frac{x^2-9}{x+3} =$ ☐ (Type an integer or a decimal.)

$f(x) = \frac{x^2-9}{x+3}$

Answers −5.9

−5.99

−5.999

−5.9999

−6.1

−6.01

−6.001

−6.0001

−6

$f(-2.9) = \frac{(2.9)^2-9}{-2.9+3}$

$f(-2.9) = \frac{(-2.9)(-2.9)-9}{-2.9+3}$

$f(-2.9) = \frac{8.41-9}{-2.9+3}$

$f(-2.9) = \frac{-.59}{.1}$

ID: 2.2.7

$f(-2.9) = -5.9$

#2 Part 2

$$f(x) = \frac{x^2 - 9}{x+3}$$

$$f(-2.99) = \frac{(-2.99)^2 - 9}{-2.99 + 3} = -5.99$$

$$f(-2.999) = \frac{(-2.999)^2 - 9}{-2.999 + 3} = -5.999$$

$$f(-2.9999) = \frac{(-2.9999)^2 - 9}{-2.9999 + 3} = -5.9999$$

$$f(-3.1) = \frac{(-3.1)^2 - 9}{-3.1 + 3} = -6.1$$

$$f(-3.01) = \frac{(-3.01)^2 - 9}{-3.01 + 3} = -6.01$$

$$f(-3.001) = \frac{(-3.001)^2 - 9}{-3.001 + 3} = -6.001$$

$$f(-3.0001) = \frac{(-3.0001)^2 - 9}{-3.0001 + 3} = -6.0001$$

Conjecture

$$\lim_{x \to -3} \frac{x^2 - 9}{x+3} = -6$$

#2 Part 3

$$\lim_{x \to -3} \frac{x^2-9}{x+3} =$$

$$\lim_{x \to -3} \frac{(x)^2-(3)^2}{x+3} =$$

$$\lim_{x \to -3} \frac{(x+3)(x-3)}{(x+3)} =$$

$$\lim_{x \to -3} \frac{\cancel{(x+3)}(x-3)}{\cancel{(x+3)}} =$$

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

$-3 - 3 =$

$\boxed{-6} =$

formula

a^2-b^2

$(a+b)(a-b)$

3. Let $g(t) = \frac{t-4}{\sqrt{t}-2}$.

a. Make two tables, one showing the values of g for t = 3.9, 3.99, and 3.999 and one showing values of g for t = 4.1, 4.01, and 4.001.

b. Make a conjecture about the value of $\lim\limits_{t \to 4} \frac{t-4}{\sqrt{t}-2}$.

a. Make a table showing the values of g for t = 3.9, 3.99, and 3.999.

t	3.9	3.99	3.999
g(t)			

(Round to four decimal places.)

Make a table showing the values of g for t = 4.1, 4.01, and 4.001.

t	4.1	4.01	4.001
g(t)			

(Round to four decimal places.)

Use a graphing Calculator

b. Make a conjecture about the value of $\lim\limits_{t \to 4} \frac{t-4}{\sqrt{t}-2}$. Select the correct choice below and fill in any answer boxes in your choice.

$$g(t) = \frac{t-4}{\sqrt{t}-2}$$

○ **A.** $\lim\limits_{t \to 4} \frac{t-4}{\sqrt{t}-2} =$ ________ (Simplify your answer.)

○ **B.** The limit does not exist.

$$g(3.9) = \frac{3.9-4}{\sqrt{3.9}-2}$$

$$g(3.9) = \frac{3.9-4}{1.974841766-2}$$

$$g(3.9) = \frac{-.1}{-.025158234}$$

Answers 3.9748

3.9975

3.9997

4.0248

4.0025

4.0003

A. $\lim\limits_{t \to 4} \frac{t-4}{\sqrt{t}-2} =$ 4 (Simplify your answer.)

$g(3.9) = 3.974841795$

ID: 2.2.9

#3 Part 2

$$g(3,99) = \frac{3,99 - 4}{\sqrt{3,99} - 2} = 3,9975$$

$$g(3,999) = \frac{3,999 - 4}{\sqrt{3,999} - 2} = 3.9997$$

$$g(4.1) = \frac{4.1 - 4}{\sqrt{4.1} - 2} = 4,0248$$

$$g(4.01) = \frac{4,01 - 4}{\sqrt{4,01} - 2} = 4,0025$$

$$g(4.001) = \frac{4,001 - 4}{\sqrt{4,001} - 2} = 4,0003$$

Conjecture of

$$\lim_{t \to 4} \frac{t - 4}{\sqrt{t} - 2} = 4$$

③ Part 3

$$\lim_{t \to 4} \frac{t-4}{\sqrt{t}-2} =$$

$$\lim_{t \to 4} \left(\frac{t-4}{\sqrt{t}-2}\right)\left(\frac{\sqrt{t}+2}{\sqrt{t}+2}\right) = \quad \leftarrow \boxed{\text{Mult}}$$

$$\lim_{t \to 4} \frac{(t-4)(\sqrt{t}+2)}{(\sqrt{t})^2 + \cancel{2\sqrt{t}} - 2\sqrt{t} - 4} =$$

$$\lim_{t \to 4} \frac{(t-4)(\sqrt{t}+2)}{(\sqrt{t})^2 - 4} =$$

$$\lim_{t \to 4} \frac{(t-4)(\sqrt{t}+2)}{(t-4)} =$$

$$\lim_{t \to 4} \frac{\cancel{(t-4)}(\sqrt{t}+2)}{\cancel{(t-4)}} =$$

$$\lim_{t \to 4} (\sqrt{t}+2) =$$

$$\sqrt{4} + 2 =$$

$$2 + 2 =$$

$$\boxed{4 =}$$

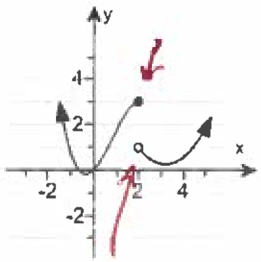
4. Use the graph to find the following limits and function value.

a. $\lim_{x \to 2^-} f(x)$

b. $\lim_{x \to 2^+} f(x)$

c. $\lim_{x \to 2} f(x)$

d. f(2)



a. Find the limit. Select the correct choice below and fill in any answer boxes in your choice.

● **A.** $\lim_{x \to 2^-} f(x) =$ 3 (Type an integer.)

○ **B.** The limit does not exist.

b. Find the limit. Select the correct choice below and fill in any answer boxes in your choice.

● **A.** $\lim_{x \to 2^+} f(x) =$ 1 (Type an integer.)

○ **B.** The limit does not exist.

c. Find the limit. Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** $\lim_{x \to 2} f(x) =$ ______ (Type an integer.)

● **B.** The limit does not exist.

d. Find the function value. Select the correct choice below and fill in any answer boxes in your choice.

● **A.** f(2) = 3 (Type an integer.)

○ **B.** The answer is undefined.

Answers A. $\lim_{x \to 2^-} f(x) =$ 3 (Type an integer.)

A. $\lim_{x \to 2^+} f(x) =$ 1 (Type an integer.)

B. The limit does not exist.

A. f(2) = 3 (Type an integer.)

ID: 2.2.15

5. Explain why $\lim\limits_{x \to 6} \dfrac{x^2 - 9x + 18}{x - 6} = \lim\limits_{x \to 6} (x - 3)$, and then evaluate $\lim\limits_{x \to 6} \dfrac{x^2 - 9x + 18}{x - 6}$.

Choose the correct answer below.

- ○ **A.** The limits $\lim\limits_{x \to 6} \dfrac{x^2 - 9x + 18}{x - 6}$ and $\lim\limits_{x \to 6} (x - 3)$ equal the same number when evaluated using direct substitution.
- ○ **B.** Since each limit approaches 6, it follows that the limits are equal.
- ○ **C.** The numerator of the expression $\dfrac{x^2 - 9x + 18}{x - 6}$ simplifies to $x - 3$ for all x, so the limits are equal.
- ○ **D.** Since $\dfrac{x^2 - 9x + 18}{x - 6} = x - 3$ whenever $x \neq 6$, it follows that the two expressions evaluate to the same number as x approaches 6.

Now evaluate the limit.

$\lim\limits_{x \to 6} \dfrac{x^2 - 9x + 18}{x - 6} =$ ☐ (Simplify your answer.)

Answers D.

Since $\dfrac{x^2 - 9x + 18}{x - 6} = x - 3$ whenever $x \neq 6$, it follows that the two expressions evaluate to the same number as x approaches 6.

3

$$\lim_{x \to 6} \frac{x^2 - 9x + 18}{x - 6} =$$

ID: 2.3.5

$$\lim_{x \to 6} \frac{(x-3)(x-6)}{(x-6)} =$$

$$\lim_{x \to 6} \frac{(x-3)\cancel{(x-6)}}{\cancel{(x-6)}} =$$

$$\lim_{x \to 6} (x-3) =$$

$$6 - 3 =$$

$$\boxed{3 =}$$

✓

6. Assume $\lim_{x\to 4} f(x) = 8$ and $\lim_{x\to 4} h(x) = 4$. Compute the following limit and state the limit laws used to justify the computation.

$$\lim_{x\to 4} \frac{f(x)}{h(x)}$$

$\lim_{x\to 4} \frac{f(x)}{h(x)} =$ ☐ (Simplify your answer.)

Select each limit law used to justify the computation.

- ☐ **A.** Constant multiple
- ☐ **B.** Difference
- ☐ **C.** Power
- ☐ **D.** Product
- ☐ **E.** Root
- ☑ **F.** Quotient
- ☐ **G.** Sum

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

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

$$\frac{8}{4} =$$

$$\boxed{2 =}$$ ✓

Answers 2

F. Quotient

ID: 2.3.8

7. Find the following limit or state that it does not exist.

$$\lim_{x\to 1} \frac{\sqrt{x}-1}{x-1}$$

Simplify the given limit.

$\lim_{x\to 1} \frac{\sqrt{x}-1}{x-1} = \lim_{x\to 1}$ (☐) (Simplify your answer.)

Evaluate the limit, if possible. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{x\to 1} \frac{\sqrt{x}-1}{x-1} =$ ______ (Type an exact answer.)

○ **B.** The limit does not exist.

$$\lim_{x\to 1} \left(\frac{\sqrt{x}-1}{x-1}\right)\left(\frac{\sqrt{x}+1}{\sqrt{x}+1}\right) = \text{mult}$$

$$\lim_{x\to 1} \frac{(\sqrt{x})^2 + \cancel{1\sqrt{x}} - \cancel{1\sqrt{x}} - 1}{(x-1)(\sqrt{x}+1)} =$$

$$\lim_{x\to 1} \frac{x-1}{(x-1)(\sqrt{x}+1)} =$$

$$\lim_{x\to 1} \frac{1\cancel{(x-1)}}{\cancel{(x-1)}(\sqrt{x}+1)} =$$

$$\lim_{x\to 1} \frac{1}{\sqrt{x}+1} =$$

$$\frac{1}{\sqrt{1}+1} =$$

$$\frac{1}{1+1} =$$

$$\boxed{\frac{1}{2} =}$$ ✓

Answers $\frac{1}{\sqrt{x}+1}$

A. $\lim_{x\to 1} \frac{\sqrt{x}-1}{x-1} = \boxed{\frac{1}{2}}$ (Type an exact answer.)

ID: 2.3.41-Setup & Solve

8. Determine the following limit.

$$\lim_{w\to\infty}\frac{48w^2+3w+1}{\sqrt{36w^4+2w^3}}$$

formula $\lim_{x\to\infty}\frac{1}{x^n}=0$

Select the correct choice below, and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{w\to\infty}\frac{48w^2+3w+1}{\sqrt{36w^4+2w^3}} =$ ______ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor $-\infty$.

Answer: A. $\lim_{w\to\infty}\frac{48w^2+3w+1}{\sqrt{36w^4+2w^3}} = \boxed{8}$ (Simplify your answer.)

mult

ID: 2.5.29

$$\lim_{w\to\infty}\left(\frac{48w^2+3w+1}{\sqrt{36w^4+2w^3}}\right)\frac{\sqrt{\frac{1}{w^4}}}{\sqrt{\frac{1}{w^4}}} =$$

$$\lim_{w\to\infty}\left(\frac{48w^2+3w+1}{\sqrt{36w^4+2w^3}}\right)\cdot\frac{\frac{1}{w^2}}{\sqrt{\frac{1}{w^4}}} =$$

$$\lim_{w\to\infty}\frac{\frac{48w^2}{w^2}+\frac{3w}{w^2}+\frac{1}{w^2}}{\sqrt{(36w^4+2w^3)\frac{1}{w^4}}} =$$

$$\lim_{w\to\infty}\frac{\frac{48\cancel{w^2}}{\cancel{w^2}}+\frac{3w}{w^2}+\frac{1}{w^2}}{\sqrt{\frac{36\cancel{w^4}}{\cancel{w^4}}+\frac{2w^3}{w^4}}} =$$

$$\lim_{w\to\infty}\frac{48+\frac{3}{w}+\frac{1}{w^2}}{\sqrt{36+\frac{2}{w}}} =$$

$$\frac{48+0+0}{\sqrt{36+0}} =$$

$$\frac{48}{\sqrt{36}} =$$

$$\frac{48}{6} =$$

$$8 =$$ ✓

9. Determine $\lim_{x \to \infty} f(x)$ and $\lim_{x \to -\infty} f(x)$ for the following function. Then give the horizontal asymptotes of f, if any.

formula $\lim_{x \to \infty} \frac{1}{x^n} = 0$

$$f(x) = \frac{8x}{16x+4}$$

Evaluate $\lim_{x \to \infty} f(x)$. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{x \to \infty} \frac{8x}{16x+4} =$ ________ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor $-\infty$.

Evaluate $\lim_{x \to -\infty} f(x)$. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{x \to -\infty} \frac{8x}{16x+4} =$ ________ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor $-\infty$.

Give the horizontal asymptotes of f, if any. Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

○ **A.** The function has one horizontal asymptote, ________ .
(Type an equation.)

○ **B.** The function has two horizontal asymptotes. The top asymptote is ________ and the bottom asymptote is ________ .
(Type equations.)

○ **C.** The function has no horizontal asymptotes.

Answers A. $\lim_{x \to \infty} \frac{8x}{16x+4} = \boxed{\frac{1}{2}}$ (Simplify your answer.)

A. $\lim_{x \to -\infty} \frac{8x}{16x+4} = \boxed{\frac{1}{2}}$ (Simplify your answer.)

A. The function has one horizontal asymptote, $\boxed{y = \frac{1}{2}}$. (Type an equation.)

✓

ID: 2.5.37

$\lim_{x \to \infty} \left(\frac{8x}{16x+4}\right) \frac{\frac{1}{x}}{\frac{1}{x}} =$ mult

$$\lim_{x \to \infty} \frac{\frac{8x}{x}}{\frac{16x}{x} + \frac{4}{x}} = \lim_{x \to \infty} \frac{8}{16 + \frac{4}{x}} = \frac{8}{16+0} = \frac{8}{16} = \frac{8(1)}{8(2)} = \frac{1}{2} =$$

horizontal asymptote

$y = \frac{1}{2}$

10. Evaluate $\lim_{x \to \infty} f(x)$ and $\lim_{x \to -\infty} f(x)$ for the following rational function. Use ∞ or − ∞ where appropriate. Then give the horizontal asymptote of f (if any).

$$f(x) = \frac{12x^2 - 9x + 7}{4x^2 + 2}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{x \to \infty} f(x) =$ ______ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor − ∞.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{x \to -\infty} f(x) =$ ______ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor − ∞.

Identify the horizontal asymptote. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The horizontal asymptote is y = ______.

○ **B.** There are no horizontal asymptotes.

formula

$$\lim_{x \to \infty} \frac{1}{x^n} = 0$$

Answers A. $\lim_{x \to \infty} f(x) =$ **3** (Simplify your answer.)

A. $\lim_{x \to -\infty} f(x) =$ **3** (Simplify your answer.)

A. The horizontal asymptote is y = **3**.

ID: 2.5.39

$$\lim_{x \to \infty} \left(\frac{12x^2 - 9x + 7}{4x^2 + 2} \right) \frac{\frac{1}{x^2}}{\frac{1}{x^2}} =$$

$$\lim_{x \to \infty} \frac{\frac{12\cancel{x^2}}{\cancel{x^2}} - \frac{9x}{x^2} + \frac{7}{x^2}}{\frac{4\cancel{x^2}}{\cancel{x^2}} + \frac{2}{x^2}} =$$

$$\lim_{x \to \infty} \frac{12 - \frac{9}{x} + \frac{7}{x^2}}{4 + \frac{2}{x^2}} =$$

$$\frac{12 - 0 + 0}{4 + 0} =$$

$$\frac{12}{4} =$$

$$3 =$$

horizontal asymptote

$y = 3$

11. Determine $\lim_{x\to\infty} f(x)$ and $\lim_{x\to-\infty} f(x)$ for the following function. Then give the horizontal asymptotes of f, if any.

$$f(x) = \frac{5x^5-5}{x^6+7x^4}$$

$$\text{formula} \quad \lim_{x\to\infty} \frac{1}{x^n} = 0$$

Evaluate $\lim_{x\to\infty} f(x)$. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ ✓ **A.** $\lim_{x\to\infty} \frac{5x^5-5}{x^6+7x^4} =$ ______ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor − ∞.

Evaluate $\lim_{x\to-\infty} f(x)$. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ ✓ **A.** $\lim_{x\to-\infty} \frac{5x^5-5}{x^6+7x^4} =$ ______ (Simplify your answer.)

○ **B.** The limit does not exist and is neither ∞ nor − ∞.

Identify the horizontal asymptotes. Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

○ ✓ **A.** The function has one horizontal asymptote, ______.
(Type an equation.)

○ **B.** The function has two horizontal asymptotes. The top asymptote is ______ and the bottom asymptote is ______.
(Type equations.)

○ **C.** The function has no horizontal asymptotes.

Answers A. $\lim_{x\to\infty} \frac{5x^5-5}{x^6+7x^4} = \boxed{0}$ (Simplify your answer.)

A. $\lim_{x\to-\infty} \frac{5x^5-5}{x^6+7x^4} = \boxed{0}$ (Simplify your answer.)

A. The function has one horizontal asymptote, $\boxed{y=0}$. (Type an equation.)

ID: 2.5.41

$$\lim_{x\to\infty} \left(\frac{5x^5-5}{x^6-7x^4}\right) \frac{\frac{1}{x^6}}{\frac{1}{x^6}} =$$

$$\lim_{x\to\infty} \frac{\frac{5x^5}{x^6} - \frac{5}{x^6}}{\frac{x^6}{x^6} - \frac{7x^4}{x^6}} =$$

$$\lim_{x\to\infty} \frac{\frac{5}{x} - \frac{5}{x^6}}{1 - \frac{7}{x^2}} =$$

$$\frac{0-0}{1-0} = \frac{0}{1} = 0 =$$

horizontal asymptote $y = 0$ ✓

12. Find all the asymptotes of the function.

$$f(x) = \frac{4x^2+8}{2x^2+7x-9}$$

$$\lim_{x\to\infty}\left(\frac{4x^2+8}{2x^2+7x-9}\right)\frac{\frac{1}{x^2}}{\frac{1}{x^2}}$$

$$\lim_{x\to\infty}\frac{\frac{4x^2}{x^2}+\frac{8}{x^2}}{\frac{2x^2}{x^2}+\frac{7x}{x^2}-\frac{9}{x^2}} =$$

Find the horizontal asymptotes. Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

☑ A. The function has one horizontal asymptote, ________.
(Type an equation using y as the variable.)

$$\lim_{x\to\infty}\frac{4+\frac{8}{x^2}}{2+\frac{7}{x}-\frac{9}{x^2}} =$$

○ B. The function has two horizontal asymptotes. The top asymptote is ________ and the bottom asymptote is ________.
(Type equations using y as the variable.)

$$\frac{4+0}{2+0-0} =$$

○ C. The function has no horizontal asymptotes.

Find the vertical asymptotes. Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

$$\frac{4}{2} = 2$$

$\boxed{2=}$ horizontal asymptote $\boxed{y=2}$ ✓

○ A. The function has one vertical asymptote, ________.
(Type an equation using x as the variable.)

☑ B. The function has two vertical asymptotes. The leftmost asymptote is ________ and the rightmost asymptote is ________.
(Type equations using x as the variable.)

○ C. The function has no vertical asymptotes.

vertical asymptote

$$2x^2+7x-9=0$$

$$(2x+9)(x-1)=0$$

Find the slant asymptote(s). Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

$2x+9=0$ or $x-1=0$

$2x+9-9=0-9$ or $x-1+1=0+1$

$2x=-9$ or $\boxed{x=1}$ ✓

$\frac{2x}{2}=\frac{-9}{2}$

$\boxed{x=-\frac{9}{2}}$ Vertical Asymptote

○ A. The function has one slant asymptote, ________.
(Type an equation using x and y as the variables.)

○ B. The function has two slant asymptotes. The asymptote with the larger slope is ________ and the asymptote with the smaller slope is ________.
(Type equations using x and y as the variables.)

☑ C. The function has no slant asymptotes.

Answers A. The function has one horizontal asymptote, **y = 2**. (Type an equation using y as the variable.)

B.

The function has two vertical asymptotes. The leftmost asymptote is $x = -\frac{9}{2}$ and the rightmost asymptote is **x = 1**.
(Type equations using x as the variable.)

C. The function has no slant asymptotes.

✓

ID: EXTRA 2.66

No Slant asymptote

13. Determine the intervals on which the following function is continuous.

$$f(x) = \frac{x^2 - 7x + 12}{x^2 - 9}$$

On what interval(s) is f continuous?

(Simplify your answer. Type your answer in interval notation. Use a comma to separate answers as needed.)

Answer: $(-\infty,-3),(-3,3),(3,\infty)$

ID: 2.6.28

let $x^2 - 9 = 0$

$(x)^2 - (3)^2 = 0$

$(x+3)(x-3) = 0$

$x+3 = 0$ OR $x-3 = 0$

$x+3-3 = 0-3$ OR $x-3+3 = 0+3$

$\boxed{x=-3}$ OR $\boxed{x=3}$ undefined

Continuous on

$$\boxed{(-\infty,-3) \cup (-3,3) \cup (3,\infty)}$$

---

14. Evaluate the following limit.

$$\lim_{x \to 5} \sqrt{x^2 + 24}$$

$= \sqrt{(5)^2 + 24} = \sqrt{25+24} = \sqrt{49} = \boxed{7}$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☑ **A.** $\lim_{x \to 5} \sqrt{x^2 + 24} =$ ____, because $x^2 + 24$ is continuous for all x and the square root function is continuous for all $x \geq 0$.
(Type an integer or a fraction.)

○ **B.** The limit does not exist and is neither ∞ nor $-\infty$.

Answer: A.

$\lim_{x \to 5} \sqrt{x^2 + 24} =$ 7, because $x^2 + 24$ is continuous for all x and the square root function is continuous for all $x \geq 0$.
(Type an integer or a fraction.)

ID: 2.6.53

---

15. Suppose x lies in the interval (1,5) with $x \neq 3$. Find the smallest positive value of δ such that the inequality $0 < |x-3| < \delta$ is true for all possible values of x.

The smallest positive value of δ is ____. (Type an integer or a fraction.)

Answer: 2

ID: 2.7.1

format
$|x| < a$
$-a < x < a$

$0 < |x-3| < \delta$

$-\delta < x-3 < \delta$

$-\delta + 3 < x \cancel{-3} \cancel{+3} < \delta + 3$

$-\delta + 3 < x < \delta + 3$

let $-\delta + 3 = 1$

$-\delta + 3 - 3 = 1 - 3$

$-\delta = -2$

$-1(-\delta) = -1(-2)$

$\boxed{\delta = 2}$

OR

$\delta + 3 = 5$

$\delta + 3 - 3 = 5 - 3$

$\boxed{\delta = 2}$

OR

16. Use the precise definition of a limit to prove the following limit. Specify a relationship between ε and δ that guarantees the limit exists.

$$\lim_{x \to 0} (6x - 9) = -9$$

Let ε > 0 be given. Choose the correct proof below.

✓ ○ **A.** Choose $\delta = \frac{\varepsilon}{6}$. Then, $|(6x-9) - -9| < \varepsilon$ whenever $0 < |x - 0| < \delta$.

○ **B.** Choose $\delta = \varepsilon$. Then, $|(6x-9) - -9| < \varepsilon$ whenever $0 < |x - 0| < \delta$.

○ **C.** Choose $\delta = 6\varepsilon$. Then, $|(6x-9) - -9| < \varepsilon$ whenever $0 < |x - 0| < \delta$.

○ **D.** Choose $\delta = \frac{\varepsilon}{9}$. Then, $|(6x-9) - -9| < \varepsilon$ whenever $0 < |x - 0| < \delta$.

○ **E.** None of the above proofs is correct.

$$|(6x-9) - (-9)| < e$$
$$|6x - 9 + 9| < e$$
$$|6x| < e$$
$$|6||x| < e$$
$$6|x| < e$$
$$\frac{\cancel{6}x}{\cancel{6}} < \frac{e}{6}$$
$$x < \frac{e}{6}$$

Answer: A. Choose $\delta = \frac{\varepsilon}{6}$. Then, $|(6x-9) - -9| < \varepsilon$ whenever $0 < |x - 0| < \delta$.

let $\delta = \frac{e}{6}$ ✓

ID: 2.7.19

Let $\delta = \frac{e}{6}$ then $|(6x-9) - (-9)| < e$ whenever $0 < |x - 0| < \delta = \frac{e}{6}$

---

17. Find the average velocity of the function over the given interval.

over $[a, b]$

$y = \frac{3}{x-2}$, [4,7]
a b

○ **A.** 7

○ **B.** $-\frac{3}{10}$

○ **C.** 2

○ **D.** $\frac{1}{3}$

Answer: B. $-\frac{3}{10}$

ID: 2.1-3

$$\frac{f(b) - f(a)}{b - a} =$$
$$\frac{f(7) - f(4)}{(7) - (4)} =$$
$$\frac{\frac{3}{7-2} - \frac{3}{4-2}}{(7) - (4)} =$$
$$\frac{\frac{3}{5} - \frac{3}{2}}{7 - 4} =$$
$$\frac{\frac{3}{5} - \frac{3}{2}}{\frac{3}{1}} =$$
$$\frac{\frac{3}{5}\left(\frac{2}{2}\right) - \frac{3}{2}\left(\frac{5}{5}\right)}{\frac{3}{1}} =$$
$$\frac{\frac{6}{10} - \frac{15}{10}}{\frac{3}{1}} =$$
$$\frac{\frac{6-15}{10}}{\frac{3}{1}} =$$
$$\frac{\frac{-9}{10}}{\frac{3}{1}} =$$
$$-\frac{9}{10} \cdot \frac{1}{3} =$$
$$\frac{-3(\cancel{3})}{10} \cdot \frac{1}{\cancel{3}} =$$
$$-\frac{3}{10} =$$

✓

18. Find all vertical asymptotes of the given function. set $x^2 + 64x = 0$

$$g(x) = \frac{x+11}{x^2+64x}$$

$$x(x+64) = 0$$

$$\boxed{x = 0} \quad \text{or} \quad x + 64 = 0$$

$$x + 64 - 64 = 0 - 64$$

$$\boxed{x = -64}$$

○ A. $x = 0, x = -64$
○ B. $x = 0, x = -8, x = 8$
○ C. $x = -8, x = 8$
○ D. $x = -64, x = -11$

vertical asymptotes

$$\boxed{x = 0} \text{ or } \boxed{x = -64}$$ ✓✓

Answer: A. $x = 0, x = -64$

ID: 2.4-19

19. Divide numerator and denominator by the highest power of x in the denominator to find the limit at infinity.

$$\lim_{x \to \infty} \frac{\sqrt[3]{x} + 6x - 6}{-3x + x^{2/3} - 4} = \lim_{x \to \infty} \left(\frac{x^{1/3} + 6x^{3/3} - 6}{-3x^{3/3} + x^{2/3} - 4} \right) \frac{\frac{1}{x^{3/3}}}{\frac{1}{x^{3/3}}}$$

○ A. -2
○ B. $-\frac{1}{2}$
○ C. $-\infty$
○ D. 0

$$= \lim_{x \to \infty} \left(\frac{\frac{x^{1/3}}{x^{3/3}} + \frac{6\cancel{x^{3/3}}}{\cancel{x^{3/3}}} - \frac{6}{x^{3/3}}}{\frac{-3\cancel{x^{3/3}}}{\cancel{x^{3/3}}} + \frac{x^{2/3}}{x^{3/3}} - \frac{4}{x^{3/3}}} \right) =$$

Answer: A. -2

ID: 2.5-12

$$\lim_{x \to \infty} \frac{\frac{1}{x^{3/3 - 1/3}} + 6 - \frac{6}{x^{3/3}}}{-3 + \frac{1}{x^{3/3 - 2/3}} + \frac{4}{x^{3/3}}} =$$

$$\lim_{x \to \infty} \frac{\frac{1}{x^{2/3}} + 6 - \frac{6}{x}}{-3 + \frac{1}{x^{1/3}} + \frac{4}{x}} =$$

✓

$$\frac{0 + 6 - 0}{-3 + 0 + 0} = \frac{6}{-3} = \boxed{-2}$$

20. Use the graph to find a $\delta > 0$ such that for all x, $0 < |x - x_0| < \delta$ and $|f(x) - L| < \varepsilon$. Use the following information: $f(x) = x + 3$, $\varepsilon = 0.2$, $x_0 = 2$, $L = 5$.

[1] Click the icon to view the graph.

○ A. 0.1
○ B. 0.4
○ C. 3
[✓ D. 0.2]

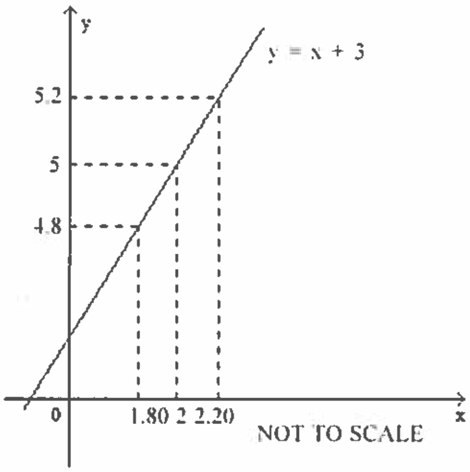
$|(x+3) - (5)| < 0.2$

$|x+3-5| < 0.2$

$|x-2| < 0.2$

$\delta = 0.2$ ✓

1: Graph



Answer: D. 0.2

ID: 2.7-1

---

21. Find the value of the derivative of the function at the given point.

$f(x) = 2x^2 - 4x$; $(-1,6)$

$f'(-1) =$ ☐ (Type an integer or a simplified fraction.)

Answer: −8

ID: 3.1.1

Formula

$y = x^n$

$y' = nx^{n-1}$

$y = ax$

$y' = a$

$f(x) = 2x^2 - 4x$

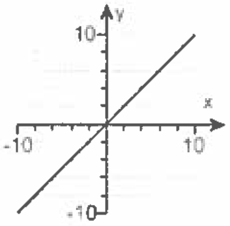
$f'(x) = 4x - 4$

$f'(-1) = 4(-1) - 4$

$f'(-1) = -4 - 4$

$f'(-1) = -8$ ✓

22. Match the graph of the function on the right with the graph of its derivative.



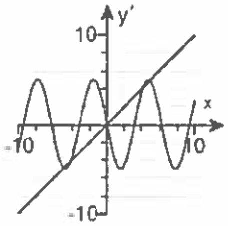
$y = x$

h

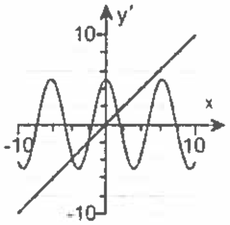
$y' = 1$

Choose the correct graph of the function (in blue) and its derivative (in red) below.

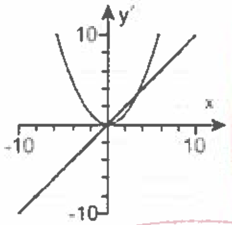
○ **A.**



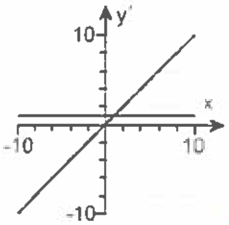
○ **B.**



○ **C.**



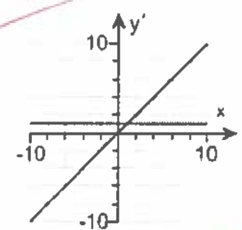
● **D.**



Examples

$y = x$	$y' = 1$
$y = x^2$	$y' = 2x$
$y = x^3$	$y' = 3x^2$
$y = x^4$	$y' = 4x^3$

Answer:



D.

ID: 3.2.49

---

23. Evaluate the derivative of the function given below using a limit definition of the derivative.

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

$f'(x) =$ ☐

Answer: 2x − 3

ID: EXTRA 3.2

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} =$$

$$\lim_{h \to 0} \frac{((x+h)^2 - 3(x+h) + 1) - (x^2 - 3x + 1)}{h} =$$

$$\lim_{h \to 0} \frac{(x+h)(x+h) - 3x - 3h + 1 - x^2 + 3x - 1}{h} =$$

$$\lim_{h \to 0} \frac{\cancel{x^2} + xh + xh + h^2 \cancel{-3x} - 3h \cancel{+1} \cancel{-x^2} \cancel{+3x} \cancel{-1}}{h}$$

$$\lim_{h \to 0} \frac{2xh + h^2 - 3h}{h} =$$

$$\lim_{h \to 0} (2x + h - 3) =$$

$$2x + (0) - 3 =$$

$$2x - 3$$

$$f'(x) = 2x - 3$$

24. Use the Quotient Rule to evaluate and simplify $\frac{d}{dx}\left(\frac{x-6}{4x-3}\right)$.

$$y' = \frac{(x-6)'(4x-3) - (x-6)(4x-3)'}{(4x-3)^2}$$

$\frac{d}{dx}\left(\frac{x-6}{4x-3}\right) =$ ☐

$$y' = \frac{(1-0)(4x-3) - (x-6)(4-0)}{(4x-3)^2}$$

$y = \frac{f}{g}$ formula

$y' = \frac{f'g - fg'}{g^2}$

$$y' = \frac{(1)(4x-3) - (x-6)(4)}{(4x-3)^2}$$

Answer: $\frac{21}{(4x-3)^2}$

$$y' = \frac{4x-3-4x+24}{(4x-3)^2}$$

$$\boxed{y' = \frac{21}{(4x-3)^2}}$$

✓

ID: 3.4.5

25. **a.** Use the Product Rule to find the derivative of the given function.
b. Find the derivative by expanding the product first.

$y = fg$
$y' = f'g + fg'$ formula

f(x) = (x − 6)(2x + 3)

a. Use the product rule to find the derivative of the function. Select the correct answer below and fill in the answer box(es) to complete your choice.

○ **A.** The derivative is (x − 6)(☐) + (2x + 3)(☐).
○ **B.** The derivative is (☐) x(2x + 3).
○ **C.** The derivative is (☐)(x − 6).
○ **D.** The derivative is (x − 6)(2x + 3) + (☐).
○ **E.** The derivative is (x − 6)(2x + 3)(☐).

$y' = (x-6)'(2x+3) + (x-6)(2x+3)'$
$y' = (1-0)(2x+3) + (x-6)(2+0)$
$y' = (1)(2x+3) + (x-6)(2)$
$y' = 2x+3+2x-12$
$\boxed{y' = 4x-9}$ ✓

OR

b. Expand the product.

$y = (x-6)(2x+3)$

(x − 6)(2x + 3) = ☐ (Simplify your answer.)

$y = 2x^2+3x-12x-18$
$\boxed{y = 2x^2-9x-18}$ ✓

Using either approach, $\frac{d}{dx}(x-6)(2x+3) =$ ☐.

$y' = 4x-9-0$

Answers A. The derivative is (x − 6)(2) + (2x + 3)(1).

$2x^2 - 9x - 18$

$4x - 9$

$\boxed{y' = 4x-9}$ ✓

ID: 3.4.9

26. If f(x) = **sin** x, then what is the value of $f'\left(\frac{3\pi}{2}\right)$?

$f(x) = \sin x$
$f'(x) = \cos(x)\cdot(x)'$
$f'(x) = \cos(x)\cdot 1$
$f'(x) = \cos(x)$

formula
$y = \sin(f(x))$
$y' = \cos(f(x))\cdot f'(x)$

$f'\left(\frac{3\pi}{2}\right) =$ ☐ (Simplify your answer.)

Answer: 0

$f'\left(\frac{3\pi}{2}\right) = \cos\left(\frac{3\pi}{2}\right)$

$\boxed{f'\left(\frac{3\pi}{2}\right) = 0}$ ✓

ID: 3.5.5

27. Evaluate the limit.

$$\lim_{x\to0}\left(\frac{\sin 5x}{\sin 7x}\right)\frac{\frac{1}{x}}{\frac{1}{x}} = \lim_{x\to0}\frac{\frac{\sin(5x)}{x}}{\frac{\sin(7x)}{x}} = \lim_{x\to0}\frac{\frac{\sin(5x)}{x}}{\frac{\sin(7x)}{x}}\,\frac{\frac{5}{5}}{\frac{7}{7}} = \lim_{x\to0}\frac{\frac{5\sin(5x)}{5x}}{\frac{7\sin(7x)}{7x}} =$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $\lim_{x\to0}\frac{\sin 5x}{\sin 7x} =$ ______

○ **B.** The limit is undefined.

$$\frac{5}{7}\lim_{x\to0}\frac{\frac{\sin(5x)}{5x}}{\frac{\sin(7x)}{7x}} =$$

Formula

$$\lim_{x\to0}\frac{\sin(Ax)}{(Ax)} = 1$$

Answer: A. $\lim_{x\to0}\frac{\sin 5x}{\sin 7x} = \boxed{\frac{5}{7}}$

$$\frac{5}{7}\cdot\frac{\lim_{x\to0}\frac{\sin(5x)}{5x}}{\lim_{x\to0}\frac{\sin(7x)}{7x}} =$$

$$\frac{5}{7}\cdot\frac{1}{1} = \frac{5}{7}$$

ID: 3.5.13

28. Find $\frac{dy}{dx}$ for the following function.

$y = 7\sin x + 6\cos x$

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

$y = 7\sin(x) + 6\cos(x)$

$y' = 7\cos(x) - 6\sin(x)$

formula

OR

$y = \sin(f(x))$

$y' = \cos(f(x))\cdot f'(x)$

Answer: $7\cos x - 6\sin x$

$\frac{dy}{dx} = 7\cos(x) - 6\sin(x)$

$y = \cos(f(x))$

$y' = -\sin f(x)\cdot f'(x)$

ID: 3.5.23

29. Find the derivative of the following function.

$y = e^{-x}\sin x$

formula

$y = f g$

$y' = f'g + fg'$

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

$y' = (e^{-x})'(\sin x) + (e^{-x})(\sin x)'$

$y' = (e^{-x}(-x)')(\sin x) + (e^{-x})(\cos(x)(x)')$

Answer: $e^{-x}(\cos x - \sin x)$

$y' = (e^{-x}(-1))(\sin x) + (e^{-x})(\cos(x)\cdot 1)$ ✓

$y' = -e^{-x}\sin(x) + e^{-x}\cos(x)$

ID: 3.5.25

$y' = e^{-x}\cos(x) - e^{-x}\sin(x) = e^{-x}(\cos(x) - \sin(x))$

30. Find an equation of the line tangent to the following curve at the given point.

$y = -6x^2 + 5\sin x;\ P(0,0)$

$y' = -12x + 5\cos(x)$

$y'(0) = -12(0) + 5\cos(0)$

$y - y_1 = m(x - x_1)$ Formula

$y - (0) = 5(x - (0))$

$y - 0 = 5(x - 0)$

$y = 5(x)$

$y = 5x$ ✓

The equation for the tangent line is ______.

$y'(0) = 0 + 5(1)$

$y'(0) = 0 + 5$

Answer: $y = 5x$

ID: EXTRA 3.73

$y'(0) = 5 = m = \text{slope}$

Slope $m = 5$

$(x_1, y_1) = (0, 0)$

31. Let h(x) = f(g(x)) and p(x) = g(f(x)). Use the table below to compute the following derivatives.

formula

a. h′(2)

b. p′(1)

$h'(x) = f'(g(x)) \cdot g'(x)$

$p'(x) = g'(f(x)) \cdot f'(x)$

h′(2) = ☐ (Simplify your answer.)

p′(1) = ☐ (Simplify your answer.)

x	1	2	3	4
f(x)	1	3	2	4
f′(x)	−6	−9	−3	−1
g(x)	4	1	3	2
g′(x)	$\frac{7}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{5}{8}$

$h'(2) = f'(g(2)) \cdot g'(2)$

$h'(2) = f'(1) \cdot \frac{1}{8}$

$h'(2) = -6 \cdot \frac{1}{8}$

$h'(2) = \frac{-6}{8}$

$h'(2) = \frac{2(-3)}{2(4)}$

$\boxed{h'(2) = \frac{-3}{4}}$ ✓

$p'(1) = g'(f(1)) \cdot f'(1)$

$p'(1) = g'(1) \cdot (-6)$

$p'(1) = \frac{7}{8} \cdot (-6)$

$p'(1) = \frac{-42}{8}$

$p'(1) = \frac{2(-21)}{2(4)}$

$\boxed{p'(1) = \frac{-21}{4}}$ ✓

Answers $-\frac{3}{4}$

$-\frac{21}{4}$

ID: 3.7.25

---

32. Calculate the derivative of the following function.

$y = (4x-7)^8$

$\frac{dy}{dx} =$ ☐

Answer: $32(4x-7)^7$

ID: 3.7.27

$y = (4x-7)^8$

$y' = 8(4x-7)^{8-1} \cdot (4x-7)'$

$y' = 8(4x-7)^7 \cdot (4-0)$

$y' = 8(4x-7)^7 (4)$

$\boxed{y' = 32(4x-7)^7}$ ✓

formula

$y = (f(x))^N$

$y' = N(f(x))^{N-1} \cdot f'(x)$

---

33. Calculate the derivative of the following function.

$y = 3\left(6x^5+1\right)^{-4}$

$\frac{dy}{dx} =$ ☐

Answer: $\frac{-360x^4}{\left(6x^5+1\right)^5}$

ID: 3.7.31

$y = 3(6x^5+1)^{-4}$

$y' = -12(6x^5+1)^{-4-1} \cdot (6x^5+1)'$

$y' = -12(6x^5+1)^{-5} \cdot (30x^4+0)$

$y' = -12(6x^5+1)^{-5} \cdot (30x^4)$

$y' = \frac{-12(30x^4)}{(6x^5+1)^5}$

$\boxed{y' = \frac{-360x^4}{(6x^5+1)^5}}$ ✓

formula

$y = (f(x))^N$

$y' = N(f(x))^{N-1} \cdot f'(x)$

34. Calculate the derivative of the following function.

$y = \cos(7t + 4)$

$\frac{dy}{dt} =$ ☐

Answer: $-7\sin(7t+4)$

ID: 3.7.32

formula

$y = \cos(f(x))$

$y' = -\sin(f(x)) \cdot f'(x)$

$y = \cos(7t+4)$

$y' = -\sin(7t+4) \cdot (7t+4)'$

$y' = -\sin(7t+4) \cdot (7+0)$

$y' = -\sin(7t+4) \cdot (7)$

$y' = -7\sin(7t+4)$

✓

---

35. Calculate $\frac{dy}{dx}$ using implicit differentiation.

$x = y^4$

$\frac{dy}{dx} =$ ☐

Answer: $\frac{1}{4y^3}$

ID: 3.8.5

$x = y^4$

$(x)' = (y^4)'$

$1 = 4y^{4-1} \cdot y'$

$1 = 4y^3 \cdot y'$

$\frac{1}{4y^3} = \frac{\cancel{4y^3} y'}{\cancel{4y^3}}$

$\frac{1}{4y^3} = y'$

OR

$\frac{dy}{dx} = \frac{1}{4y^3}$

✓

---

36. Carry out the following steps for the given curve.

a. Use implicit differentiation to find $\frac{dy}{dx}$.

b. Find the slope of the curve at the given point.

$x^3 + y^3 = 0$; $(-4, 4)$

a. Use implicit differentiation to find $\frac{dy}{dx}$.

$\frac{dy}{dx} =$ ☐

b. Find the slope of the curve at the given point.

The slope of $x^3 + y^3 = 0$ at $(-4, 4)$ is ☐.
(Simplify your answer.)

Answers $\frac{-x^2}{y^2}$

-1

ID: 3.8.13

$x^3 + y^3 = 0$

$(-4, 4)$ x_1, y_1

$3x^2 + 3y^2 \cdot y' = 0$

$\cancel{3x^2} + 3y^2 \cdot y' - \cancel{3x^2} = 0 - 3x^2$

$3y^2 \cdot y' = -3x^2$

$\frac{\cancel{3y^2} \cdot y'}{\cancel{3y^2}} = \frac{-3x^2}{3y^2}$

$y' = \frac{-3x^2}{3y^2}$

$y' = -\frac{1x^2}{y^2}$

OR

$\frac{dy}{dx} = -\frac{x^2}{y^2}$

✓

$y'(\underset{x_1}{-4}, \underset{y_1}{4}) = \frac{-1(-4)^2}{(4)^2}$

$= \frac{-1(-4)(-4)}{(4)(4)}$

$= \frac{-16}{16} = -1$

✓

37. Find $\frac{d}{dx}\left(\ln\sqrt{x^2+10}\right)$.

$\frac{d}{dx}\left(\ln\sqrt{x^2+10}\right) =$ ☐

Answer: $\frac{x}{x^2+10}$

ID: 3.9.9

$y = \ln\sqrt{x^2+10}$

$y = \ln(x^2+10)^{1/2}$

$y = \frac{1}{2}\ln(x^2+10)$

$y' = \frac{1}{2}\frac{(x^2+10)'}{(x^2+10)}$

$y' = \frac{1}{2}\frac{(2x+0)}{(x^2+10)}$

$y = \frac{1}{\cancel{2}}\frac{\cancel{2}x}{(x^2+10)}$

$\boxed{y' = \frac{x}{x^2+10}}$

formula
$\ln(f(x))^n = n\ln f(x)$

formula
$y = \ln(f(x))$
$y' = \frac{f'(x)}{f(x)}$

38. Evaluate the derivative of the function.

$f(x) = \sin^{-1}\left(7x^5\right)$

$f'(x) =$ ☐

Answer: $\frac{35x^4}{\sqrt{1-49x^{10}}}$

ID: 3.10.13

$f'(x) = \frac{(7x^5)'}{\sqrt{1-(7x^5)^2}}$

$f'(x) = \frac{35x^4}{\sqrt{1-(7x^5)(7x^5)}}$

$\boxed{f'(x) = \frac{35x^4}{\sqrt{1-49x^{10}}}}$

formula
$y = \sin^{-1}(f(x))$
$y' = \frac{f'(x)}{\sqrt{1-(f(x))^2}}$

39. Find the derivative of the function $y = 3\tan^{-1}(3x)$.

$\frac{dy}{dx} =$ ☐

Answer: $\frac{9}{1+(3x)^2}$

ID: 3.10.19

$y' = 3\frac{(3x)'}{1+(3x)^2}$

$\boxed{y' = 3\frac{3}{1+(3x)^2}}$

$\boxed{y' = \frac{9}{1+(3x)^2}}$

formula
$y = \tan^{-1}f(x)$
$y' = \frac{f'(x)}{1+(f(x))^2}$

40. Evaluate the derivative of the following function.

$f(s) = \cot^{-1}\left(e^s\right)$

$\frac{d}{ds}\cot^{-1}\left(e^s\right) =$ ☐

Answer: $-\frac{e^s}{1+e^{2s}}$

ID: 3.10.39

$f'(s) = -\frac{(e^s)'}{1+(e^s)^2}$

$f'(s) = \frac{-(e^s(s)')}{1+(e^s)^2}$

$f'(s) = \frac{-(e^s(1))}{1+(e^s)^2}$

$\boxed{f'(s) = -\frac{e^s}{1+e^{2s}}}$

formula
$y = \cot^{-1}(f(x))$
$y' = -\frac{f'(x)}{1+(f(x))^2}$

41. The sides of a square increase in length at a rate of 6 m/sec.

$\frac{ds}{dt} = 6$

a. At what rate is the area of the square changing when the sides are 15 m long?
b. At what rate is the area of the square changing when the sides are 23 m long?

$s' = 15$ $s' = 23$

a. Write an equation relating the area of a square, A, and the side length of the square, s.

$A = s^2$

Differentiate both sides of the equation with respect to t.

$$\frac{dA}{dt} = (2s)\frac{ds}{dt}$$

$s' = 15$

$$\frac{dA}{dt} = 2(15)(6) = \frac{dA}{dt} = 180$$

The area of the square is changing at a rate of ______ (1) ______ when the sides are 15 m long.

b. The area of the square is changing at a rate of ______ (2) ______ when the sides are 23 m long.

$s = 23$

$$\frac{dA}{dt} = 2(23)(6) = 276$$

(1) ○ m / s
○ m^3 / s
○ m^2 / s
○ m

(2) ○ m^3 / s
○ m
○ m^2 / s
○ m / s

Answers $A = s^2$

2s

180

(1) m^2 / s

276

(2) m^2 / s

$A = s^2$

$$\frac{dA}{dt} = 2s\frac{ds}{dt}$$

ID: 3.11.11-Setup & Solve

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42. Find an equation for the tangent to the curve at the given point.

$y = x^2 - 4$, (4,12)

$y' = 2x - 0$

$y' = 2x$

$y'(4) = 2(4)$

$y'(4) = 8 = m$ slope

$m = 8 =$ slope

$(x_1, y_1) = (4, 12)$
x_1 y_1

○ **A.** y = 8x − 40
○ **B.** y = 8x − 36
○ **C.** y = 4x − 20
● **D.** y = 8x − 20

$y - y_1 = m(x - x_1)$ Formula

$y - (12) = 8(x - (4))$

$y - 12 = 8(x - 4)$

$y - 12 = 8x - 32$

$y - 12 + 12 = 8x - 32 + 12$

$y = 8x - 20$ D

Answer: D. y = 8x − 20

ID: 3.1-2

43. At time t, the position of a body moving along the s-axis is $s = t^3 - 9t^2 + 24t$ m. Find the displacement of the body from t = 0 to t = 3.

○ **A.** 22 m
○ **B.** 18 m
○ **C.** 20 m
○ **D.** 42 m

Answer: B. 18 m

ID: 3.6-3

$S(3) - S(0)$

$((3)^3 - 9(3)^2 + 24(3)) - ((0)^3 - 9(0)^2 + 24(0)) =$

$(27 - 9(9) + 24(3)) - (0 - 0 + 0) =$

$(27 - 81 + 72) - (0) =$

$(-54 + 72) - (0) =$

$18 - 0 =$

$\boxed{18} =$

✓

---

44. Use implicit differentiation to find dy/dx.

$xy + x = 2$

○ **A.** $-\frac{1+x}{y}$
○ **B.** $-\frac{1+y}{x}$
○ **C.** $\frac{1+x}{y}$
○ **D.** $\frac{1+y}{x}$

Answer: B. $-\frac{1+y}{x}$

ID: 3.8-4

formula

$y = f \cdot g$

$y' = f'g + fg'$

$(xy)' + (x)' = (2)'$

$(x)'(y) + (x)(y)' + 1 = 0$

$(1)(y) + (x)(y') + 1 = 0$

$y + xy' + 1 = 0$

$y + xy' + \cancel{1} \cancel{-1} = 0 - 1$

$y + xy' = -1$

$\cancel{y} + xy' \cancel{- y} = -1 - y$

$xy' = -1 - y$

$\frac{\cancel{x}y'}{\cancel{x}} = \frac{-1-y}{x}$

$y' = \frac{-1-y}{x}$

$y' = \frac{-1(1+y)}{x}$

$\boxed{y' = -\frac{1+y}{x}}$ OR $\boxed{\frac{dy}{dx} = -\frac{1+y}{x}}$

✓

45. Find the derivative of the function.

$y = \log_4 \sqrt{9x + 3}$

○ **A.** $\frac{9}{\ln 4\ (9x + 3)}$

○ **B.** $\frac{9}{2(\ln 4)(9x + 3)}$

○ **C.** $\frac{9 \ln 4}{9x + 3}$

○ **D.** $\frac{9}{\ln 4}$

Answer: B. $\frac{9}{2(\ln 4)(9x + 3)}$

ID: 3.9-11

$y = \log_4 \sqrt{9x+3}$

$y = \log_4 (9x+3)^{\frac{1}{2}}$

$y = \frac{1}{2}\log_4(9x+3)$

$y' = \frac{1}{2}\ \frac{(9x+3)'}{(9x+3)\ln(4)}$

$y' = \frac{1}{2}\ \frac{(9+0)}{(9x+3)\ln(4)}$

$y' = \frac{1}{2}\ \frac{9}{(9x+3)\ln(4)}$

$y' = \frac{9}{2(\ln(4))(9x+3)}$

formula

$y = \ln f(x)$

$y' = \frac{f'(x)}{f(x)}$

$y = \log_b(f(x))$

$y' = \frac{f'(x)}{\ln(b)\, f(x)}$

---

46. Boyle's law states that if the temperature of a gas remains constant, then PV = c, where P = pressure, V = volume, and c is a constant. Given a quantity of gas at constant temperature, if V is decreasing at a rate of 9 in^3/sec, at what rate is P increasing when P = 80 lb/in^2 and V = 50 in^3? (Do not round your answer.)

○ **A.** $\frac{64}{25}$ lb / in^2 per sec

○ **B.** $\frac{4000}{9}$ lb / in^2 per sec

○ **C.** $\frac{45}{8}$ lb / in^2 per sec

○ **D.** $\frac{72}{5}$ lb / in^2 per sec

Answer: D. $\frac{72}{5}$ lb / in^2 per sec

ID: 3.11-7

$\frac{dV}{dt} = -9$

$P = 80$

$V = 50$

$PV = c$

$(PV)' = (c)'$

$(P)'(V) + (P)(V)' = 0$

$P'V + PV' = 0$

$\frac{dP}{dt}V + P\frac{dV}{dt} = 0$

$\frac{dP}{dt}(50) + (80)(-9) = 0$

$50\frac{dP}{dt} - 720 = 0$

$50\frac{dP}{dt} - 720 + 720 = 0 + 720$

$50\frac{dP}{dt} = 720$

$\frac{50\frac{dP}{dt}}{80} = \frac{720}{50}$

$\frac{dP}{dt} = \frac{72\cancel{0}}{5\cancel{0}}$ ✓

$\frac{dP}{dt} = \frac{72}{5}$

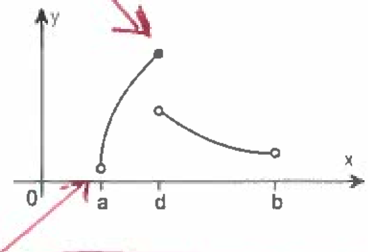
formula

$y = fg$

$y' = f'g + fg'$

47. Determine from the graph whether the function has any absolute extreme values on [a, b].

absolute max only



Where do the absolute extreme values of the function occur on [a, b]?

No Absolute minimum

● A. The absolute maximum occurs at x = d and there is no absolute minimum on [a, b].
○ B. There is no absolute maximum and the absolute minimum occurs at x = a on [a, b].
○ C. There is no absolute maximum and there is no absolute minimum on [a, b].
○ D. The absolute maximum occurs at x = d and the absolute minimum occurs at x = a on [a, b].

Answer: A. The absolute maximum occurs at x = d and there is no absolute minimum on [a, b].

ID: 4.1.13

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48. Find the critical points of the following function.

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

$f(x) = 5x^2 + 3x - 2$
$f'(x) = 10x + 3 - 0$
$f'(x) = 10x + 3$

What is the derivative of $f(x) = 5x^2 + 3x - 2$?

$f'(x) =$ ______

Find the critical points, if any, of f on the domain. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

set $10x + 3 = 0$
$10x + 3 - 3 = 0 - 3$
$10x = -3$
$\frac{10x}{10} = \frac{-3}{10}$

● A. The critical point(s) occur(s) at x = ______.
(Use a comma to separate answers as needed.)
○ B. There are no critical points for $f(x) = 5x^2 + 3x - 2$ on the domain.

Answers 10x + 3

A. The critical point(s) occur(s) at x = $-\frac{3}{10}$.(Use a comma to separate answers as needed.)

$x = -\frac{3}{10}$

ID: 4.1.23-Setup & Solve

Critical point

49. Find the critical points of the following function.

$$f(x) = -\frac{x^3}{3} + 9x$$

$f(x) = -\frac{1}{3}x^3 + 9x$

$f'(x) = -\frac{1}{3}(3x^2) + 9$

$f'(x) = -1x^2 + 9$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☑ A. The critical point(s) occur(s) at x = ______.
(Use a comma to separate answers as needed.)

○ B. There are no critical points.

Set $-x^2 + 9 = 0$

$9 - x^2 = 0$

$(3)^2 - (x)^2 = 0$

Answer: A. The critical point(s) occur(s) at x = **3, − 3**.(Use a comma to separate answers as needed.)

$(3 + x)(3 - x) = 0$

$3 + x = 0$ or $3 - x = 0$

$3 + x - 3 = 0 - 3$ ✓

$\boxed{x = -3}$

$\cancel{3} - x - \cancel{3} = 0 - 3$

$-x = -3$

$\frac{-x}{-1} = \frac{-3}{-1}$ ✓

$\boxed{x = 3}$ ✓

Critical points
$x = -3$, $x = 3$ ✓

ID: 4.1.25

---

50. Determine the location and value of the absolute extreme values of f on the given interval, if they exist.

$f(x) = -x^2 + 12$ on $[-3,4]$ →

$f'(x) = -2x + 0$

$[-3, 4]$

What is/are the absolute maximum/maxima of f on the given interval? Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

$f'(x) = -2x$

○ A. The absolute maximum/maxima is/are ______ at x = ______
(Use a comma to separate answers as needed.)

○ B. There is no absolute maximum of f on the given interval.

Set $-2x = 0$

$\frac{-2x}{-2} = \frac{0}{-2}$

What is/are the absolute minimum/minima of f on the given interval? Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

$\boxed{x = 0}$ Critical point

○ A. The absolute minimum/minima is/are ______ at x = ______
(Use a comma to separate answers as needed.)

○ B. There is no absolute minimum of f on the given interval.

$\boxed{x = -3}$ Critical point

$\boxed{x = 4}$ Critical point

Answers A. The absolute maximum/maxima is/are **12** at x = **0**.
(Use a comma to separate answers as needed.)

A. The absolute minimum/minima is/are **− 4** at x = **4**.
(Use a comma to separate answers as needed.)

$f(x) = -x^2 + 12$

ID: 4.1.43

$f(-3) = -(-3)^2 + 12 = -(-3)(-3) + 12 = -9 + 12 = 3$

$f(0) = -(0)^2 + 12 = -(0)(0) + 12 = 0 + 12 = 12$

$f(4) = -(4)^2 + 12 = -(4)(4) + 12 = -16 + 12 = -4$

absolute maximum $(0, 12)$ ✓

absolute minimum $(4, -4)$ ✓

51. A stone is launched vertically upward from a cliff 384 ft above the ground at a speed of 32 ft / s. Its height above the ground t seconds after the launch is given by $s = -16t^2 + 32t + 384$ for $0 \le t \le 6$. When does the stone reach its maximum height?

Find the derivative of s.

s′ = ☐

The stone reaches its maximum height at ☐ s.
(Simplify your answer.)

Answers $-32t + 32$

1

ID: 4.1.73

$s'(t) = -32t + 32 \neq 0$

$s'(t) = -32t + 32$

$-32t + 32 = 0$

$-32t + 32 - 32 = 0 - 32$

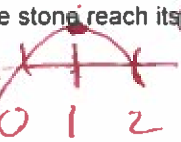
$-32t = -32$

$\frac{-32t}{-32} = \frac{-32}{-32}$

$t = 1$

Max at $t = 1$ ✓

$s'(t) = -32t + 32$



$s'(0) = -32(0) + 32 = 32 > 0$ inc

$s'(2) = -32(2) + 32 = -64 + 32$
$= -32 < 0$
dec

52. At what points c does the conclusion of the Mean Value Theorem hold for $f(x) = x^3$ on the interval $[-14, 14]$?

The conclusion of the Mean Value Theorem holds for c = ☐
(Use a comma to separate answers as needed. Type an exact answer, using radicals as needed.)

Answer: $\frac{14\sqrt{3}}{3}, -\frac{14\sqrt{3}}{3}$

ID: 4.2.8

$f(x) = x^3$

$f'(x) = 3x^2$

$\frac{f(b) - f(a)}{b - a} = f'(c)$

formula
$y = x^n$
$y' = nx^{n-1}$

$\frac{f(14) - f(-14)}{(14) - (-14)} = 3x^2$

$\frac{(14)^3 - (-14)^3}{(14) - (-14)} = 3x^2$

$\frac{(2744) - (-2744)}{14 + 14} = 3x^2$

$\frac{2744 + 2744}{28} = 3x^2$

$\frac{5488}{28} = 3x^2$

$196 = 3x^2$

$\frac{196}{3} = \frac{3x^2}{3}$

$\frac{196}{3} = x^2$

$\pm\sqrt{\frac{196}{3}} = \sqrt{x^2}$

$\pm\frac{\sqrt{196}}{\sqrt{3}} = x$

$\pm\frac{14}{\sqrt{3}} = x$

$\pm\frac{14}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) = x$ mult

$\pm\frac{14\sqrt{3}}{\sqrt{9}} = x$

$\pm\frac{14\sqrt{3}}{3} = x$ ✓✓

$X = \frac{14\sqrt{3}}{3}$ OR $X = \frac{-14\sqrt{3}}{3}$

53. **a.** Determine whether the Mean Value Theorem applies to the function $f(x) = 6 - x^2$ on the interval $[-1,2]$.
b. If so, find the point(s) that are guaranteed to exist by the Mean Value Theorem.

$f'(x) = 0 - 2x = -2x$

$f'(x) = -2x$

a b

a. Choose the correct answer below.

$\frac{f(b) - f(a)}{b - a} = -2x$

$\frac{f(2) - f(-1)}{(2) - (-1)} = -2x$

○ **A.** Yes, because the function is continuous on the interval $[-1,2]$ and differentiable on the interval $(-1,2)$.

○ **B.** No, because the function is differentiable on the interval $(-1,2)$, but is not continuous on the interval $[-1,2]$.

○ **C.** No, because the function is continuous on the interval $[-1,2]$, but is not differentiable on the interval $(-1,2)$.

○ **D.** No, because the function is not continuous on the interval $[-1,2]$, and is not differentiable on the interval $(-1,2)$.

$\frac{(6 - (2)^2) - (6 - (-1)^2)}{2 + 1} = -2$

$\frac{(6 - 4) - (6 - (1))}{3} = -2$

$\frac{(2) - (5)}{3} = -2x$

b. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The point(s) is/are x = ______.
(Simplify your answer. Use a comma to separate answers as needed.)

○ **B.** The Mean Value Theorem does not apply in this case.

$-\frac{3}{3} = -2x$

$-1 = -2x$

Answers A. Yes, because the function is continuous on the interval $[-1,2]$ and differentiable on the interval $(-1,2)$.

A. The point(s) is/are x = $\boxed{\frac{1}{2}}$.

(Simplify your answer. Use a comma to separate answers as needed.)

$\frac{-1}{-2} = \frac{-2x}{-2}$ ✓

$\frac{1}{2} = x$

ID: 4.2.21

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54. Find the intervals on which f is increasing and the intervals on which it is decreasing.

$f'(x) = -2x$

$f(x) = 10 - x^2$ $\quad f'(x) = 0 - 2x = -2x$

set $-2x = 0$

$\frac{-2x}{-2} = \frac{0}{-2}$

Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

$x = 0$ Critical Point

○ **A.** The function is increasing on ______ and decreasing on ______.
(Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

−1 0 1

○ **B.** The function is decreasing on ______. The function is never increasing.
(Simplify your answer. Type your answer in interval notation. Use a comma to separate answers as needed.)

$f'(x) = -2x$

○ **C.** The function is increasing on ______. The function is never decreasing.
(Simplify your answer. Type your answer in interval notation. Use a comma to separate answers as needed.)

$f'(-1) = -2(-1) = 2 > 0$ inc

○ **D.** The function is never increasing nor decreasing.

$f'(1) = -2(1) = -2 < 0$ decrea

Answer: A. The function is increasing on $\boxed{(-\infty,0)}$ and decreasing on $\boxed{(0,\infty)}$.
(Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

increasing $(-\infty, 0)$ ✓✓

ID: 4.3.19

decreasing $(0, \infty)$ ✓✓

55. Find the intervals on which f is increasing and the intervals on which it is decreasing.

$f(x) = -9 - x + 3x^2$

Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice.

✓ ○ **A.** The function is increasing on __________ and decreasing on __________.
(Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

○ **B.** The function is increasing on __________. The function is never decreasing.
(Simplify your answer. Type your answer in interval notation. Use a comma to separate answers as needed.)

○ **C.** The function is decreasing on __________. The function is never increasing.
(Simplify your answer. Type your answer in interval notation. Use a comma to separate answers as needed.)

○ **D.** The function is never increasing nor decreasing.

Answer: A. The function is increasing on $\left(\frac{1}{6},\infty\right)$ and decreasing on $\left(-\infty,\frac{1}{6}\right)$.

(Simplify your answers. Type your answers in interval notation. Use a comma to separate answers as needed.)

ID: 4.3.25

$f(x) = -9 - x + 3x^2$

$f'(x) = 0 - 1 + 6x$

$f'(x) = -1 + 6x$

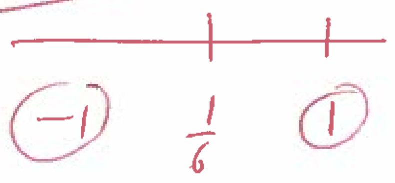
let $-1 + 6x = 0$

$\cancel{-1} + 6x + \cancel{1} = 0 + 1$

$6x = 1$

$\frac{6x}{6} = \frac{1}{6}$ ✓✓

$x = 1/6$ Critical Point



$f'(x) = -1 + 6x$

$f'(-1) = -1 + 6(-1) = -1 - 6 = -7 < 0$ decreasing

$f'(1) = -1 + 6(1) = -1 + 6 = 5 > 0$ increasing

increasing $(\frac{1}{6}, \infty)$ ✓ decreasing $(-\infty, \frac{1}{6})$ ✓

56. Locate the critical points of the following function. Then use the Second Derivative Test to determine whether they correspond to local maxima, local minima, or neither.

$f(x) = -x^3 + 15x^2$ → $f'(x) = -3x^2 + 30x$ $f''(x) = -6x + 30$

What is(are) the critical point(s) of f? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

$-3x^2 + 30x = 0$

$-3x(x - 10) = 0$

○ **A.** The critical point(s) is(are) x = ________.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

○ **B.** There are no critical points for f.

$-3x = 0$ OR $x - 10 = 0$

$\frac{-3x}{-3} = \frac{0}{-3}$ OR $x - 10 + 10 = 0 + 10$

$x = 0$ OR $x = 10$

Find f''(x).

f''(x) = ________

What is/are the local minimum/minima of f? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The local minimum/minima of f is/are at x = ________.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

○ **B.** There is no local minimum of f.

What is/are the local maximum/maxima of f? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The local maximum/maxima of f is/are at x = ________.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

○ **B.** There is no local maximum of f.

Answers A. The critical point(s) is(are) x = **0,10**.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

$-6x + 30$

A. The local minimum/minima of f is/are at x = **0**.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

A. The local maximum/maxima of f is/are at x = **10**.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

ID: 4.3.77-Setup & Solve $f''(x) = -6x + 30$

$f''(0) = -6(0) + 30 = 0 + 30 = 30 > 0$ concave up ∪ min

$f''(10) = -6(10) + 30 = -60 + 30 = -30 < 0$ concave down ∩ max

minimum at $x = 0$ ✓✓

maximum at $x = 10$ ✓✓

57. Locate the critical points of the following function. Then use the Second Derivative Test to determine whether they correspond to local maxima, local minima, or neither.

$f(x) = -2x^3 - 12x^2 + 8$

$f'(x) = -6x^2 - 24x + 0 = f''(x) = -12x - 24$

What is(are) the critical point(s) of f? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

$-6x^2 - 24x = 0$

$-6x(x+4) = 0$

○ **A.** The critical point(s) is(are) x = ____
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

○ **B.** There are no critical points for f.

$-6x = 0$ OR $x + 4 = 0$

What is/are the local maximum/maxima of f? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

$\frac{-6x}{-6} = \frac{0}{-6}$ OR $x + 4 - 4 = 0 - 4$

○ **A.** The local maximum/maxima of f is/are at x = ____.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

○ **B.** There is no local maximum of f.

$x = 0$ OR $x = -4$ critical points

What is/are the local minimum/minima of f? Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

$f''(x) = -12x - 24$

○ **A.** The local minimum/minima of f is/are at x = ____.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

○ **B.** There is no local minimum of f.

$f''(0) = -12(0) - 24$

$f''(0) = 0 - 24$

Answers A. The critical point(s) is(are) x = 0, −4.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

A. The local maximum/maxima of f is/are at x = 0

$f''(0) = -24 < 0$ concave down max

(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

A. The local minimum/minima of f is/are at x = −4.
(Use a comma to separate answers as needed. Type an integer or a simplified fraction.)

max $x = 0$

min $x = -4$

$f''(-4) = -12(-4) - 24$

$f''(-4) = 48 - 24$

ID: 4.3.83

58. Use a linear approximation to estimate the following quantity. Choose a value of a to produce a small error.

$f''(-4) = 24 > 0$ concave up min

ln (1.09)

$\ln(1.09)$

What is the value found using the linear approximation?

ln (1.09) ≈ ____ (Round to two decimal places as needed.)

Answer: 0.09

$f(x) = \ln(x)$

$f'(x) = \frac{1}{x}$

$L(1.09) = 0 + .09$

$L(1.09) = .09$ ✓

ID: 4.6.41

$L(x) = f(a) + f'(a)(x-a)$

$L(1.09) = f(1) + f'(1)(1.09 - 1)$

$L(1.09) = \ln(1) + \left(\frac{1}{1}\right)(1.09 - 1)$

$L(1.09) = 0 + (1)(.09)$

59. Consider the following function and express the relationship between a small change in x and the corresponding change in y in the form dy = f′(x)dx.

$f(x) = 2x^3 - 4x$

dy = ( ) dx

Answer: $6x^2 - 4$

ID: 4.6.67

$f(x) = 2x^3 - 4x$

$f'(x) = 6x^2 - 4$

$\frac{dy}{dx} = 6x^2 - 4$

$\frac{dy}{\cancel{dx}}(\cancel{dx}) = (6x^2 - 4)dx$

$\boxed{dy = (6x^2 - 4)\,dx}$

formula

$y = x^n$

$y' = nx^{n-1}$ ✓

---

60. Evaluate the following limit. Use l'Hôpital's Rule when it is convenient and applicable.

$$\lim_{x\to 0} \frac{6 \sin 7x}{5x}$$

Use l'Hôpital's Rule to rewrite the given limit so that it is not an indeterminate form.

$$\lim_{x\to 0} \frac{6 \sin 7x}{5x} = \lim_{x\to 0} (\quad)$$

Evaluate the limit.

$$\lim_{x\to 0} \frac{6 \sin 7x}{5x} = \underline{\qquad}$$ (Type an exact answer.)

Answers $\frac{42 \cos(7x)}{5}$

$\frac{42}{5}$

ID: 4.7.29-Setup & Solve

$\lim_{x\to 0} \frac{6\sin(7x)}{5x} =$

$\lim_{x\to 0} \frac{6\cos(7x)\cdot(7x)'}{(5x)'} =$

$\lim_{x\to 0} \frac{6\cos(7x)(7)}{(5)} =$

$\lim_{x\to 0} \frac{42\cos(7x)}{5} =$

$\frac{42\cos(7(0))}{5} =$

$\frac{42\cos(0)}{5} =$

$\frac{42(1)}{5} =$

$\boxed{\frac{42}{5} =}$ ✓

formula

$\lim_{x\to 0} \frac{f(x)}{g(x)} =$

$\lim_{x\to 0} \frac{f'(x)}{g'(x)} =$

formula

$y = \sin(f(x))$

$y' = \cos f(x) \cdot f'(x)$

61. Use a calculator or program to compute the first 10 iterations of Newton's method when they are applied to the following function with the given initial approximation.

$$\boxed{f(x) = x^2 - 23;\ x_0 = 5} \quad \boxed{f'(x) = 2x} \quad \boxed{x_0 = 5}$$

k	x_k	k	x_k
0	5,000000	6	4,795832
1	4,800000	7	4,795832
2	4,795833	8	4,795832
3	4,795832	9	4,795832
4	4,795832	10	4,795832
5	4,795832		

(Round to six decimal places as needed.)

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}$$

$$x_1 = 5 - \frac{f(5)}{f'(5)}$$

$$x_1 = 5 - \frac{(5)^2 - 23}{2(5)}$$

$$x_1 = 5 - \frac{25-23}{10}$$

$$x_1 = 5 - \frac{2}{10}$$

$$x_1 = 5 - ,10$$

$$\boxed{x_1 = 4,80000} \quad ✓$$

Answers 5.000000

4.795832

4.800000

4.795832

4.795833

4.795832

4.795832

4.795832

4.795832

4.795832

4.795832

$$x_2 = 4.8 - \frac{f(4.8)}{f'(4.8)}$$

$$x_2 = 4,8 - \frac{(4,8)^2 - 23}{2(4,8)}$$

$$x_2 = 4,8 - \frac{23.04 - 23}{9,6}$$

$$x_2 = 4,8 - \frac{.04}{9,6}$$

$$x_2 = 4,8 - .0041666667 \quad ✓$$

$$\boxed{x_2 = 4.795833333}$$

ID: 4.8.13-T

62. Determine the following indefinite integral. Check your work by differentiation.

$$\int (9x^{17} - 11x^{21})\,dx =$$

$$\frac{9x^{17+1}}{17+1} - \frac{11x^{21+1}}{21+1} + C =$$

$$\frac{9x^{18}}{18} - \frac{11x^{22}}{22} + C =$$

$$\frac{\cancel{9}x^{18}}{(\cancel{9})(2)} - \frac{\cancel{11}x^{22}}{(\cancel{11})(2)} + C =$$

$$\int (9x^{17} - 11x^{21})\,dx = \boxed{}$$ (Use C as the arbitrary constant.)

Answer: $\frac{x^{18}}{2} - \frac{x^{22}}{2} + C$

formula

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C =$$

$$\boxed{\frac{x^{18}}{2} - \frac{x^{22}}{2} + C =}$$

ID: 4.9.23

63. Evaluate the following indefinite integral.

$$\int\left(\frac{10}{\sqrt{x}}+10\sqrt{x}\right)dx$$

$\int\left(\frac{10}{\sqrt{x}}+10\sqrt{x}\right)dx =$ ☐

(Use C as the arbitrary constant.)

Answer:
$20\sqrt{x}+\frac{20}{3}x^{\frac{3}{2}}+C$

ID: 4.9.25

$$\int\left(\frac{10}{x^{\frac12}}+10x^{\frac12}\right)dx =$$

$$\int\left(10x^{-\frac12}+10x^{\frac12}\right)dx =$$

$$\frac{10x^{-\frac12+1}}{-\frac12+1}+\frac{10x^{\frac12+1}}{\frac12+1}+C=$$

$$\frac{10x^{-\frac12+\frac22}}{-\frac12+\frac22}+\frac{10x^{\frac12+\frac22}}{\frac12+\frac22}+C=$$

$$\frac{10x^{\frac12}}{\frac12}+\frac{10x^{\frac32}}{\frac32}+C=$$

$$\frac{2}{1}10x^{\frac12}+\frac{2}{3}10x^{\frac32}+C=$$

$$20x^{\frac12}+\frac{20}{3}x^{\frac32}+C=$$

$$20\sqrt{x}+\frac{20}{3}x^{\frac32}+C= \checkmark$$

64. Find $\int(6x+5)^2dx$.

$\int(6x+5)^2dx =$ ☐

(Use C as the arbitrary constant.)

Answer: $12x^3+30x^2+25x+C$

ID: 4.9.27

Formula
$$\int(f(x))^n f'(x) \qquad \frac{(f(x))^{n+1}}{n+1}+C$$

$$\frac16\int(6x+5)^2\cdot(6)\,dx$$

$$\frac16\,\frac{(6x+5)^{2+1}}{2+1}+C$$

$$\frac16\,\frac{(6x+5)^3}{3}+C$$

$$\frac{1}{18}(6x+5)^3+C \checkmark$$

OR

$$\int(6x+5)(6x+5)\,dx$$

$$\int 36x^2+30x+30x+25\,dx =$$

$$\int 36x^2+60x+25\,dx =$$

$$\frac{36x^3}{3}+\frac{60x^2}{2}+25x+C= \checkmark$$

$$12x^3+30x^2+25x+C=$$

65. Determine the following indefinite integral. Check your work by differentiation.

$$\int 4m\left(11m^2-10m\right)dm$$

$\int 4m\left(11m^2-10m\right)dm =$ ☐ (Use C as the arbitrary constant.)

Answer:
$11m^4-\frac{40m^3}{3}+C$

ID: 4.9.28

$$\int\left(44m^3-40m^2\right)dm$$

$$\frac{44m^{3+1}}{3+1}-\frac{40m^{2+1}}{2+1}+C=$$

$$\frac{44m^4}{4}-\frac{40m^3}{3}+C= \checkmark$$

$$11m^4-\frac{40m^3}{3}+C=$$

Formula

$$\int x^n\,dx =$$

$$\frac{x^{n+1}}{n+1}+C=$$

Formula

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

66. Determine the following indefinite integral. Check your work by differentiation.

$$\int\left(2x^{\frac{1}{3}} + 3x^{-\frac{1}{3}} + 11\right)dx = 2\frac{x^{\frac13+\frac33}}{\frac13+\frac33} + 3\frac{x^{-\frac13+\frac33}}{\frac43\,-\frac13+\frac33} + 11x + C =$$

$\int\left(2x^{\frac{1}{3}} + 3x^{-\frac{1}{3}} + 11\right)dx =$ ☐ (Use C as the arbitrary constant.)

$$= 2\frac{x^{\frac43}}{\frac43} + 3\frac{x^{\frac23}}{\frac23} + 11x + C =$$

$$\frac{3}{4}\,2x^{\frac43} + \frac{3}{2}\,3x^{\frac23} + 11x + C =$$

$$\frac{3}{(2)(2)}\,2x^{\frac43} + \frac{3}{2}(3x^{\frac23})$$

$$\frac{3}{2}x^{\frac43} + \frac{9}{2}x^{\frac23} + 11x + C$$

Answer: $\frac{3}{2}x^{\frac{4}{3}} + \frac{9}{2}x^{\frac{2}{3}} + 11x + C$

ID: 4.9.29

67. Determine the following indefinite integral. Check your work by differentiation.

$$\int 4\sqrt[6]{x}\,dx = \int 4x^{\frac16}\,dx = \frac{4x^{\frac16+\frac66}}{\frac16+\frac66} + C = \frac{24}{7}x^{\frac76} + C =$$

$\int 4\sqrt[6]{x}\,dx =$ ☐ (Use C as the arbitrary constant.)

$$\frac{4x^{\frac76}}{\frac76} + C =$$

$$\frac{6}{7}\,4x^{\frac76} + C =$$

Formula

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C =$$

Answer: $\frac{24}{7}x^{\frac{7}{6}} + C$

ID: 4.9.30

68. Determine the following indefinite integral. Check your work by differentiation.

$$\int(7x+1)(4-x)\,dx = \int 28x - 7x^2 + 4 - 1x\,dx =$$

$\int(7x+1)(4-x)\,dx =$ ☐

(Use C as the arbitrary constant.)

$$\int -7x^2 + 27x + 4\,dx =$$

$$\frac{-7x^{2+1}}{2+1} + \frac{27x^{1+1}}{1+1} + 4x + C =$$

$$\frac{-7x^3}{3} + \frac{27x^2}{2} + 4x + C$$

Answer: $-\frac{7}{3}x^3 + \frac{27}{2}x^2 + 4x + C$

ID: 4.9.31

formula

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

69. Determine the following indefinite integral.

$$\int \frac{4x^5 - 9x^4}{x^2}\,dx =$$

$$\int \frac{4x^5 - 9x^4}{x^2}\,dx = \boxed{}$$

(Use C as the arbitrary constant.)

Answer: $x^4 - 3x^3 + C$

ID: 4.9.35

$\int \frac{4x^5}{x^2} - \frac{9x^4}{x^2}\,dx =$

$\int 4x^3 - 9x^2\,dx =$

$\frac{4x^{3+1}}{3+1} - \frac{9x^{2+1}}{2+1} + C =$

$\frac{4x^4}{4} - \frac{9x^3}{3} + C =$

$x^4 - 3x^3 + C =$ ✓

Formula $\int x^n\,dx$ $\frac{x^{n+1}}{n+1} + C$

---

70. For the following function f, find the antiderivative F that satisfies the given condition.

$f(x) = 4x^3 + 5\sin x,\ F(0) = 2$

The antiderivative that satisfies the given condition is F(x) = $\boxed{}$.

Answer: $x^4 - 5\cos\ x + 7$

ID: 4.9.71

Formula $\int \sin f(x)\, f'(x)\,dx$ $-\cos f(x) + C$

→ ~~[illegible]~~

$\int 4x^3 + 5\sin(x)\,dx$

$\frac{4x^{3+1}}{3+1} - 5\cos(x) + C$

$4x^4 - 5\cos(x) + C$

$F(0) = 2$

$4(0)^4 - 5\cos(0) + C = 2$

$0 - 5(1) + C = 2$

$-5 + C = 2$

$-5 + C + 5 = 2 + 5$

$C = 7$ ✓

$F(x) = x^4 - 5\cos x + 7$

---

71. Given the following velocity function of an object moving along a line, find the position function with the given initial position.

$v(t) = 3t^2 + 6t - 5;\ s(0) = 0$

The position function is s(t) = $\boxed{}$.

Answer: $t^3 + 3t^2 - 5t$

ID: 4.9.95

Formula $\int x^n dx$ $\frac{x^{n+1}}{n+1} + C$

$\int 3t^2 + 8t - 5\,dx =$

$\frac{3t^{2+1}}{2+1} + \frac{8t^{1+1}}{1+1} - 5t + C$

$\frac{3x^3}{3} + \frac{8t^2}{2} - 5t + C$

$x^3 + 4t^2 - 5t + C$

$(0)^3 + 4(0)^2 - 5(0) + C = 0$

$0 + 0 - 0 + C = 0$

$C = 0$ ✓

$t^3 + 3t^2 - 5t$

---

72. Find the absolute extreme values of the function on the interval.

$F(x) = \sqrt[3]{x},\ -8 \le x \le 64$

$F(x) = x^{1/3}$, $F'(x) = \frac{1}{3}x^{1/3 - 1}$, $F'(x) = \frac{1}{3}x^{1/3 - 3/3}$

$F'(x) = \frac{1}{3}x^{-2/3}$

$F'(x) = \frac{1}{3x^{2/3}}$

x = 0 undefine

Critical Point x = −8, 0, 64

○ **A.** absolute maximum is 0 at x = 0; absolute minimum is −2 at x = −8

● **B.** absolute maximum is 4 at x = 64; absolute minimum is −2 at x = −8

○ **C.** absolute maximum is 4 at x = −64; absolute minimum is −2 at x = 64

○ **D.** absolute maximum is 4 at x = 64; absolute minimum is 0 at x = 0

$F(x) = \sqrt[3]{x}$

Answer: B. absolute maximum is 4 at x = 64; absolute minimum is −2 at x = −8

$F(-8) = \sqrt[3]{-8} = -2$ / $F(0) = \sqrt[3]{0} = 0$ / $F(64) = \sqrt[3]{64} = 4$

ID: 4.1-13

absolute maximum (64, 4) ✓

absolute minimum (−8, −2) ✓

Formula $y = x^n$ $y' = nx^{n-1}$

73.

Find the value or values of c that satisfy the equation $\frac{f(b) - f(a)}{b - a} = f'(c)$ in the conclusion of the Mean Value Theorem for the function and interval.

$f(x) = x^2 + 2x + 4, [-2,3]$

a b

$f'(x) = 2x + 2 + 0$

$f'(x) = 2x + 2$

○ A. −2, 3

○ B. $-\frac{1}{2}, \frac{1}{2}$

○ C. $\frac{1}{2}$

○ D. $0, \frac{1}{2}$

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

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

$$\frac{(9 + 6 + 4) - (4 - 4 + 4)}{5} = 2x + 2$$

$$\frac{(19) - (4)}{5} = 2x + 2$$

$$\frac{19 - 4}{5} = 2x + 2$$

$$\frac{15}{5} = 2x + 2$$

$$3 = 2x + 2$$

$$3 - 2 = 2x + \cancel{2} - \cancel{2}$$

$$1 = 2x$$

$$\frac{1}{2} = \frac{2x}{2}$$

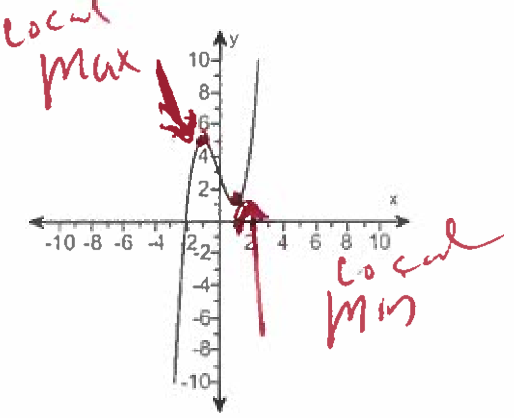
$$\boxed{\frac{1}{2} = x}$$ ✓

Answer: C. $\frac{1}{2}$

ID: 4.2-1

74.

Use the graph of the function f(x) to locate the local extrema and identify the intervals where the function is concave up and concave down.



○ A. Local minimum at x = 1; local maximum at x = − 1; concave down on (− ∞,∞)

○ B. Local minimum at x = 1; local maximum at x = − 1; concave up on (− ∞,∞)

○ C. Local minimum at x = 1; local maximum at x = − 1; concave down on (0,∞); concave up on (− ∞,0)

● D. Local minimum at x = 1; local maximum at x = − 1; concave up on (0,∞); concave down on (− ∞,0) ✓

Answer: D. Local minimum at x = 1; local maximum at x = − 1; concave up on (0,∞); concave down on (− ∞,0)

ID: 4.3-9

Local Minumum at X=1 ✓✓

Local Maximum at X=-1 ✓✓

75. From a thin piece of cardboard 30 in by 30 in, square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? Round to the nearest tenth, if necessary.

✓ ○ **A.** 20.0 in × 20.0 in × 5.0 in; 2,000.0 in^3

○ **B.** 20.0 in × 20.0 in × 10.0 in; 4,000.0 in^3

○ **C.** 15.0 in × 15.0 in × 7.5 in; 1,687.5 in^3

○ **D.** 10.0 in × 10.0 in × 10.0 in; 1,000.0 in^3

Answer: A. 20.0 in × 20.0 in × 5.0 in; 2,000.0 in^3

ID: 4.5-1

$V(x) = x(30-2x)(30-2x) = x(900-60x-60x+4x^2)$

$V(x) = x(900-120x+4x^2)$

$V(x) = 900x-120x^2+4x^3$

$V(x) = 4x^3-120x^2+900x$

$V'(x) = 12x^2-240x+900$

$V''(x) = 24x-240$

$\frac{12x^2}{12} - \frac{240x}{12} + \frac{900}{12} = \frac{0}{12}$

$x^2-20x+75=0$

$(x-5)(x-15)=0$

$x-5=0$ or $x-15=0$

$x=5$ OR $x=15$

$V''(x) = 24x-240$

$V''(5) = 24(5)-240$

$V''(5) = 120-240$

$V''(5) = -120$ Concav down $\frown$

Max at $x=5$

$V''(x) = 24x-480$

$V''(15) =$

$24(15)-240 =$

$360-240$

120 $\cup$

Concav up min

min $x = 15$

Max $x = 5$

$V(x) = x(30-2x)(30-2x)$

$V(5) = 5(30-2(5))(30-2(5))$

$V(5) = 5(30-10)(30-10)$

$V(5) = 5(20)(20)$

$V(5) = 2000$

MAX

76. Solve the initial value problem:

$$\frac{ds}{dt} = \cos t - \sin t, \quad s\left(\frac{\pi}{2}\right) = 10$$

○ **A.** $s = \sin t - \cos t + 9$

○ **B.** $s = \sin t + \cos t + 9$

○ **C.** $s = 2\sin t + 8$

○ **D.** $s = \sin t + \cos t + 11$

Answer: B. $s = \sin t + \cos t + 9$

ID: 4.9-16

$\frac{ds}{dt} = \cos(t) - \sin(t)$ $s\left(\frac{\pi}{2}\right) = 10$

$\int ds = \int \cos(t) - \sin(t)\, dt$

$s = \sin(t) + \cos(t) + c$

$s(t) = \sin(t) + \cos(t) + C$

$s\left(\frac{\pi}{2}\right) = \sin\left(\frac{\pi}{2}\right) + \cos\left(\frac{\pi}{2}\right) + C = 10$

$(1) + (0) + C = 10$

$1 + 0 + C = 10$

$1 + C = 10$

$1 + C - 1 = 10 - 1$

$C = 9$

$s(t) = \sin(t) + \cos(t) + 9$

77. Evaluate the following expressions.

a. $\sum_{k=1}^{18} k$ b. $\sum_{k=1}^{9} (2k+2)$ c. $\sum_{k=1}^{4} k^2$ d. $\sum_{n=1}^{7} \left(2+n^2\right)$

e. $\sum_{m=1}^{5} \frac{2m+2}{9}$ f. $\sum_{j=1}^{5} (4j-7)$ g. $\sum_{k=1}^{6} k(4k+9)$ h. $\sum_{n=0}^{6} \sin\frac{n\pi}{2}$

a. $\sum_{k=1}^{18} k = \boxed{171}$ (Type an integer or a simplified fraction.)

b. $\sum_{k=1}^{9} (2k+2) = \boxed{108}$ (Type an integer or a simplified fraction.)

c. $\sum_{k=1}^{4} k^2 = \boxed{30}$ (Type an integer or a simplified fraction.)

d. $\sum_{n=1}^{7} \left(2+n^2\right) = \boxed{154}$ (Type an integer or a simplified fraction.)

e. $\sum_{m=1}^{5} \frac{2m+2}{9} = \boxed{\frac{40}{9}}$ (Type an integer or a simplified fraction.)

f. $\sum_{j=1}^{5} (4j-7) = \boxed{25}$ (Type an integer or a simplified fraction.)

g. $\sum_{k=1}^{6} k(4k+9) = \boxed{553}$ (Type an integer or a simplified fraction.)

h. $\sum_{n=0}^{6} \sin\frac{n\pi}{2} = \boxed{1}$ (Type an integer or a simplified fraction.)

use graphing calculator, Math, Summation

$$\sum_{\boxed{x}=\boxed{1}}^{\boxed{18}} \boxed{(x)} = 171$$ ✓

Answers 171

108

30

154

$\frac{40}{9}$

25

553

1

ID: 5.1.49

78.

The functions f and g are integrable and $\int_3^7 f(x)dx = 9$, $\int_3^7 g(x)dx = 5$, and $\int_6^7 f(x)dx = 2$. Evaluate the integral below or state that there is not enough information.

$$-\int_7^3 3f(x)dx$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** $-\int_7^3 3f(x)dx =$ ________ (Simplify your answer.)

○ **B.** There is not enough information to evaluate $-\int_7^3 3f(x)dx$.

Answer: A. $-\int_7^3 3f(x)dx =$ **27** (Simplify your answer.)

ID: EXTRA 5.18

$$-\int_7^3 3 f(x)\,dx =$$

formula

$$\boxed{\int_3^7 f(x)\,dx = 9}$$

Flip number

$$\int_3^7 3 f(x)\,dx =$$

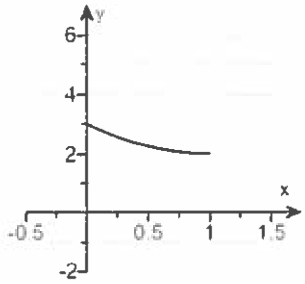
$$3\int_3^7 f(x)\,dx =$$

$$3(9) =$$

✓

$$\boxed{27 =}$$

79. Evaluate the following integral using the Fundamental Theorem of Calculus. Discuss whether your result is consistent with the figure.



$$\int_0^1 \left(x^2 - 2x + 3\right) dx$$

$$\int_0^1 (x^2-2x+3)\,dx =$$

$$\left(\frac{x^{2+1}}{2+1} - \frac{2x^{1+1}}{1+1} + 3x\right)\Big|_0^1 =$$

$$\int_0^1 \left(x^2 - 2x + 3\right) dx = \boxed{}$$

$$\left(\frac{x^3}{3} - \frac{2x^2}{2} + 3x\right)\Big|_0^1 =$$

Is your result consistent with the figure?

○ **A.** No, because the definite integral is negative and the graph of f lies above the x-axis.

○ **B.** No, because the definite integral is positive and the graph of f lies below the x-axis.

☑ **C.** Yes, because the definite integral is positive and the graph of f lies above the x-axis.

○ **D.** Yes, because the definite integral is negative and the graph of f lies below the x-axis.

Answers $\frac{7}{3}$

C. Yes, because the definite integral is positive and the graph of f lies above the x-axis.

ID: 5.3.23

$$\left(\frac{(1)^3}{3} - \frac{2(1)^2}{2} + 3(1)\right) - \left(\frac{(0)^3}{3} - \frac{2(0)^2}{2} + 3(0)\right) =$$

$$\left(\frac{1}{3} - \frac{2(1)}{2} + 3\right) - (0 - 0 + 0) =$$

$$\left(\frac{1}{3} - 1 + 3\right) - (0) =$$

$$\left(\frac{1}{3} + 2\right) - (0) =$$

$$\frac{1}{3} + \frac{2}{1}\left(\frac{3}{3}\right) =$$

$$\frac{1}{3} + \frac{6}{3} =$$

$$\frac{1+6}{3} =$$

$$\boxed{\frac{7}{3} =}$$

✓

80. Evaluate the following integral using the fundamental theorem of calculus. Sketch the graph of the integrand and shade the region whose net area you have found.

$$\int_{-1}^{5} \left(x^2 - 4x - 5\right)\,dx$$

$$\rightarrow \left(\frac{x^{2+1}}{2+1} - \frac{4x^{1+1}}{1+1} - 5x\right)\Big|_{-1}^{5} =$$

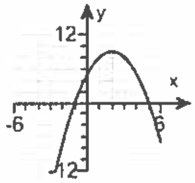
$$\left(\frac{x^3}{3} - \frac{4x^2}{2} - 5x\right)\Big|_{-1}^{5} =$$

$$\left(\frac{x^3}{3} - 2x^2 - 5x\right)\Big|_{-1}^{5}$$

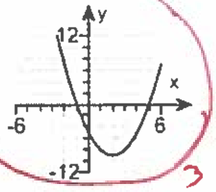
$\int_{-1}^{5} \left(x^2 - 4x - 5\right)\,dx =$ ☐

Choose the correct sketch below.

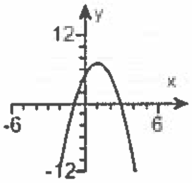
○ A.



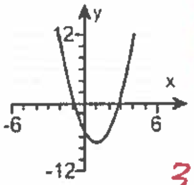
● B.



○ C.



○ D.



$$\left(\frac{(5)^3}{3} - 2(5)^2 - 5(5)\right) - \left(\frac{(-1)^3}{3} - 2(-1)^2 - 5(-1)\right) =$$

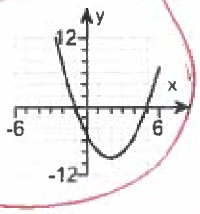
$$\left(\frac{125}{3} - 50 - 25\right) - \left(\frac{-1}{3} - 2 + 5\right) =$$

$$\frac{125}{3} - 50 - 25 + \frac{1}{3} + 2 - 5 =$$

$$\frac{126}{3} - 78 =$$

$$42 - 78 = \boxed{-36}$$

Answers −36



B.

ID: 5.3.25

---

81. Use the fundamental theorem of calculus to evaluate the following definite integral.

$$\int_{1}^{4} \left(4x^2 + 6\right)\,dx = \left(\frac{4x^{2+1}}{2+1} + 6x\right)\Big|_{1}^{4} =$$

$\int_{1}^{4} \left(4x^2 + 6\right)\,dx =$ ☐

$$\left(\frac{4x^3}{3} + 6x\right)\Big|_{1}^{4} =$$

(Type an exact answer.)

$$\left(\frac{4(4)^3}{3} + 6(4)\right) - \left(\frac{4(1)^3}{3} + 6(1)\right) =$$

Answer: 102

$$\left(\frac{4(64)}{3} + 24\right) - \left(\frac{4(1)}{3} + 6\right) =$$

ID: 5.3.29

$$\frac{256}{3} + 24 - \frac{4}{3} - 6 =$$

$$\frac{252}{3} + 18 =$$

$$84 + 18 = \boxed{102}$$

$$\left(-\frac{(7)^3}{3}+5(7)^2-21(7)\right)-\left(-\frac{(3)^3}{3}+5(3)^2-21(3)\right)$$

82. Evaluate the following integral using the Fundamental Theorem of Calculus.

$$\int_3^7 (3-x)(x-7)\,dx = \int_3^7 3x-21-x^2+7x\,dx =$$

$$= \int_3^7 -x^2+10x-21\,dx =$$

$$\int_3^7 (3-x)(x-7)\,dx = \boxed{}$$

$$-\frac{x^{2+1}}{2+1}+\frac{10x^{1+1}}{1+1}-21x\Big|_3^7 =$$

(Type an exact answer.)

$$-\frac{x^3}{3}+\frac{10x^2}{2}-21x\Big|_3^7 =$$

Answer: $\frac{32}{3}$

$$\left(-\frac{x^3}{3}+5x^2-21x\right)\Big|_3^7 =$$

ID: 5.3.41

use graphing calculator

formula
$\int x^n dx$
$\frac{x^{n+1}}{n+1}+C$

$$\frac{32}{3}$$

---

83. Find the area of the region bounded by the graph of f and the x-axis on the given interval.

$f(x) = x^2 - 40;\ [2,4]$

$$\int_2^4 (0)-(x^2-40)\,dx = \int_2^4 0-x^2+40\,dx =$$

The area is $\boxed{}$. (Type an integer or a simplified fraction.)

$$\int_2^4 -x^2+40\,dx =$$

Answer: $\frac{184}{3}$

$$-\frac{x^3}{3}+40x\Big|_2^4 =$$

ID: 5.3.67

$$\left(-\frac{(4)^3}{3}+40(4)\right)-\left(-\frac{(2)^3}{3}+40(2)\right)=$$

$$\left(-\frac{64}{3}+160\right)-\left(-\frac{8}{3}+80\right)=$$

$$-\frac{64}{3}+160+\frac{8}{3}-80=$$

$$-\frac{56}{3}+80=$$

$$-\frac{56}{3}+\frac{80}{1}\left(\frac{3}{3}\right)=$$

$$-\frac{56}{3}+\frac{240}{3}=$$

$$\frac{184}{3}$$

✓

---

84. Simplify the following expression.

$$\frac{d}{dx}\int_x^5 \sqrt{t^4+1}\,dt = \left(-\frac{d}{dx}\int_5^x \sqrt{t^4+1}\right) =$$

flip → x

$$\frac{d}{dx}\int_x^5 \sqrt{t^4+1}\,dt = \boxed{}$$

$$= -\sqrt{x^4+1}$$

✓

Answer: $-\sqrt{x^4+1}$

ID: 5.3.75

85. Simplify the following expression.

$$\frac{d}{dx}\int_{3}^{x^3}\frac{dp}{p^2}$$

$$\frac{d}{dx}\int_{3}^{x^3}\frac{dp}{p^2} = \square$$

Answer: $\frac{3}{x^4}$

ID: 5.3.77

$$\frac{d}{dx}\int_{3}^{x^3}\frac{1}{p^2}\,dp =$$

$$\frac{1}{(x^3)^2}\cdot(x^3)' =$$

$$\left(\frac{1}{x^6}\right)\cdot(3x^2) =$$

$$\frac{3x^2}{x^6} =$$

$$\boxed{\frac{3}{x^4} =}$$

✓

formula

$y = x^n$

$y' = nx^{n-1}$

---

86. Evaluate the following integral.

$$\int_{0}^{3}(x-3)^3\,dx$$

$$\int_{0}^{3}(x-3)^3\,dx = \square$$

(Type an exact answer. Use C as the arbitrary constant as needed.)

Answer: $-\frac{81}{4}$

ID: EXTRA 5.57

$$\int_{0}^{3}(x-3)^3(1)\,dx =$$

$$\frac{(x-3)^{3+1}}{3+1}\Big|_{0}^{3} =$$

$$\frac{(x-3)^4}{4}\Big|_{0}^{3} =$$

$$\left(\frac{(3-3)^4}{4}\right)-\left(\frac{(0-3)^4}{4}\right) =$$

$$\left(\frac{(0)^4}{4}\right)-\left(\frac{(-3)^4}{4}\right) =$$

$$\left(\frac{0}{4}\right)-\left(\frac{81}{4}\right) =$$

$$0-\frac{81}{4} =$$

$$\boxed{-\frac{81}{4} =}$$

✓

formula

$\int (f(x))^N \cdot f'(x)\,dx$

$\frac{(f(x))^{N+1}}{N+1} + C$

87. Find the average value of the following function over the given interval. Draw a graph of the function and indicate the average value.

$f(x) = x(x-1);\ [1,9]$

$\frac{1}{9-1}\int_1^9 x(x-1)\,dx = \frac{1}{8}\int_1^9 (x^2-x)\,dx$

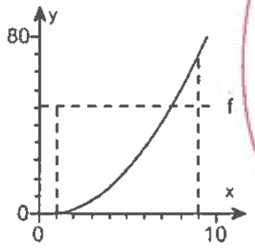
The average value of the function is $\bar{f}$ = ☐.

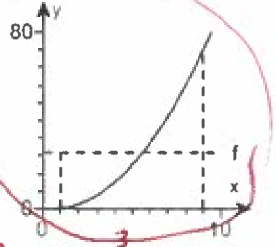
$= \frac{1}{8}\left(\frac{x^3}{3}-\frac{x^2}{2}\right)\Big|_1^9$

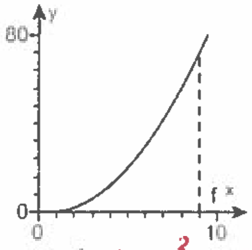
Formula
$\int x^n\,dx$
$\frac{x^{n+1}}{n+1}+C$

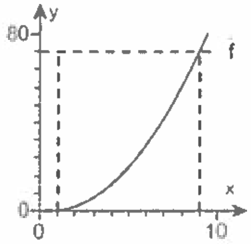
Choose the correct graph of f(x) and $\bar{f}$ below.

○ A. [✓ B.] ○ C. ○ D.









$\frac{1}{8}\left(\frac{(9)^3}{3}-\frac{(9)^2}{2}\right) - \frac{1}{8}\left(\frac{(1)^3}{3}-\frac{(1)^2}{2}\right) = \frac{1}{8}\left(\frac{1456-240}{6}\right)$

Answers $\frac{76}{3}$

$\frac{1}{8}\left(\frac{729}{3}-\frac{81}{2}\right) - \frac{1}{8}\left(\frac{1}{3}-\frac{1}{2}\right) =$

$\frac{1}{8}\left(\frac{729}{3}-\frac{81}{2}-\frac{1}{3}+\frac{1}{2}\right) =$

$\frac{1}{8}\left(\frac{728}{3}-\frac{80}{2}\right) =$

$\frac{1}{8}\left(\frac{728}{3}\left(\frac{2}{2}\right)-\frac{80}{2}\left(\frac{3}{3}\right)\right) =$

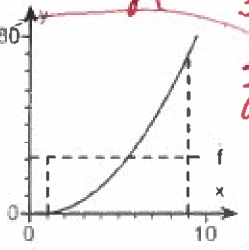
$\frac{1}{8}\left(\frac{1456}{6}-\frac{240}{6}\right) =$

$= \frac{1}{8}\left(\frac{1216}{6}\right)$

$= \frac{152}{6}$

$= \frac{156}{(2)(3)}$

$= \boxed{\frac{76}{3}}$ ✓



B.

ID: 5.4.30

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88. Find the point(s) at which the function f(x) = 5 − 4x equals its average value on the interval [0,2].

a b

The function equals its average value at x = ☐.
(Use a comma to separate answers as needed.)

Answer: 1

ID: 5.4.39

$\frac{1}{2-0}\int_0^2 (5-4x)\,dx$

$\frac{1}{2}\int_0^2 (5-4x)\,dx$

$\frac{1}{2}\left(5x-\frac{4x^2}{2}\right)\Big|_0^2$

$\frac{1}{2}(5x-2x^2)\Big|_0^2$

$\frac{1}{2}(5(2)-2(2)^2) - \frac{1}{2}(5(0)-2(0)^2) =$

$\frac{1}{2}(10-8) - \frac{1}{2}(0-0) =$

$\frac{1}{2}(2) - \frac{1}{2}(0)$

$1-0=1$

Formula
$\int x^n\,dx$
$\frac{x^{n+1}}{n+1}+C$

Set

$5-4x=1$

$5-4x-5=1-5$

$-4x=-4$

$\frac{-4x}{-4}=\frac{-4}{-4}$

$\boxed{x=1}$ ✓

89. Use the substitution $u = x^2 + 6$ to find the following indefinite integral. Check your answer by differentiation.

$$\int 2x\left(x^2+6\right)^5 dx$$

$= \int (x^2+6)^5 (2x)\, dx$

$\int 2x\left(x^2+6\right)^5 dx = \square$

(Use C as the arbitrary constant.)

$= \dfrac{(x^2+6)^{5+1}}{5+1} + C$

Answer: $\frac{1}{6}\left(x^2+6\right)^6 + C$

$= \boxed{\dfrac{(x^2+6)^6}{6} + C}$

✓

formula

$\int (f(x))^N \cdot f'(x)\, dx$

$\dfrac{(f(x))^{N+1}}{N+1} + C$

ID: 5.5.7

---

90. Use the substitution $u = 6x^2 - 5$ to find the following indefinite integral. Check your answer by differentiation.

$$\int -12x \sin\left(6x^2-5\right) dx$$

$= \int \sin(6x^2-5)(-12x)\, dx =$

$-1 \int \sin(6x^2-5)(12x)\, dx =$

$-1(-\cos(6x^2-5)) + C =$

$\int -12x \sin\left(6x^2-5\right) dx = \square$

(Use C as the arbitrary constant.)

Answer: $\cos\left(6x^2-5\right) + C$

$\boxed{\cos(6x^2-5) + C} =$

formula

$\int \sin f(x) \cdot f'(x) =$

$\cos(f(x)) + C$

ID: 5.5.8

---

91. Use the substitution $u = 5x^2 + 2x$ to evaluate the indefinite integral below.

$$\int (10x+2)\sqrt{5x^2+2x}\, dx$$

$= \int \sqrt{5x^2+2x}\,(10x+2)\, dx =$

$\int (5x^2+2x)^{\frac{1}{2}} (10x+2)\, dx =$

Write the integrand in terms of u.

$\int (10x+2)\sqrt{5x^2+2x}\, dx = \int \square\, du$

$\dfrac{(5x^2+2x)^{\frac{1}{2}+1}}{\frac{1}{2}+1} + C =$ $\quad \frac{1}{2} + \frac{2}{2}$

Evaluate the integral.

$\int (10x+2)\sqrt{5x^2+2x}\, dx = \square$

(Use C as the arbitrary constant.)

$\dfrac{(5x^2+2x)}{\frac{1}{2}+\frac{2}{2}} + C =$

Answers $\sqrt{u}$

$\frac{2}{3}\left(5x^2+2x\right)^{\frac{3}{2}} + C$

$\dfrac{(5x^2+2x)^{\frac{3}{2}}}{\frac{3}{2}} + C =$

$\boxed{\frac{2}{3}(5x^2+2x)^{\frac{3}{2}} + C} =$

formula

$\int (f(x))^N \cdot f'(x)\, dx$

$\dfrac{(f(x))^{N+1}}{N+1} + C$

ID: 5.5.10-Setup & Solve

92. Use a change of variables or the accompanying table to evaluate the following indefinite integral.

$$\int \frac{e^{2x}}{e^{2x}+7}\,dx$$

[2] Click the icon to view the table of general integration formulas.

formula

$$\int \frac{f'(x)}{f(x)}\,dx = \ln|f(x)| + C$$

Determine a change of variables from x to u. Choose the correct answer below.

○ **A.** $u = e^{2x}$

○ **B.** $u = \frac{1}{e^{2x}+7}$

○ **C.** $u = e^{2x}+7$

○ **D.** $u = 2x$

$$\frac{1}{2}\int \frac{e^{2x}(2)}{e^{2x}+7} =$$

$$\frac{1}{2}\ln|e^{2x}+7| + C =$$

Write the integral in terms of u.

$$\int \frac{e^{2x}}{e^{2x}+7}\,dx = \int (\quad)\,du$$

Evaluate the integral.

$$\int \frac{e^{2x}}{e^{2x}+7}\,dx = \boxed{\quad}$$

(Use C as the arbitrary constant.)

formula NOT here

2: General Integration Formulas

$$\int \cos ax\,dx = \frac{1}{a}\sin ax + C \qquad \int \sin ax\,dx = -\frac{1}{a}\cos ax + C$$

$$\int \sec^2 ax\,dx = \frac{1}{a}\tan ax + C \qquad \int \csc^2 ax\,dx = -\frac{1}{a}\cot ax + C$$

$$\int \sec ax\tan ax\,dx = \frac{1}{a}\sec ax + C \qquad \int \csc ax\cot ax\,dx = -\frac{1}{a}\csc ax + C$$

$$\int e^{ax}dx = \frac{1}{a}e^{ax} + C \qquad \int b^x dx = \frac{1}{\ln b}b^x + C,\ b>0,\ b\neq 1$$

$$\int \frac{dx}{a^2+x^2} = \frac{1}{a}\tan^{-1}\frac{x}{a} + C \qquad \int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\frac{x}{a} + C,\ a>0$$

$$\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\sec^{-1}\left|\frac{x}{a}\right| + C,\ a>0$$

Answers C. $u = e^{2x}+7$

$$\frac{1}{2u}$$

$$\frac{1}{2}\ln\left|e^{2x}+7\right| + C$$

ID: 5.5.44-Setup & Solve

formula

$\int \cos(f(x)) \cdot f'(x)$

$\sin(f(x)) + c$

93. Use a change of variables or the table to evaluate the following definite integral.

$$\int_0^{\pi/42} \cos 7x\,dx \;=\; \frac{1}{7}\int_0^{\pi/42} \cos(7x)(7)\,dx$$

$$\frac{1}{7}\sin(7x)\Big|_0^{\pi/42}$$

³ Click to view the table of general integration formulas.

$\int_0^{\pi/42} \cos 7x\,dx =$ ____ (Type an exact answer.)

3: General Integration Formulas

$$\int \cos ax\,dx = \frac{1}{a}\sin ax + C$$

$$\int \sec^2 ax\,dx = \frac{1}{a}\tan ax + C$$

$$\int \sec ax \tan ax\,dx = \frac{1}{a}\sec ax + C$$

$$\int e^{ax}dx = \frac{1}{a}e^{ax} + C$$

$$\int \frac{dx}{a^2+x^2} = \frac{1}{a}\tan^{-1}\frac{x}{a} + C$$

$$\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\sec^{-1}\left|\frac{x}{a}\right| + C,\ a>0$$

$$\int \sin ax\,dx = -\frac{1}{a}\cos ax + C$$

$$\int \csc^2 ax\,dx = -\frac{1}{a}\cot ax + C$$

$$\int \csc ax \cot ax\,dx = -\frac{1}{a}\csc ax + C$$

$$\int b^x dx = \frac{1}{\ln b}b^x + C,\ b>0,\ b\neq 1$$

$$\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\frac{x}{a} + C,\ a>0$$

Answer: $\frac{1}{14}$

$$\left(\frac{1}{7}\sin\left(7\left(\frac{\pi}{42}\right)\right)\right) - \left(\frac{1}{7}\sin(0)\right) =$$

$$\left(\frac{1}{7}\sin\left(\frac{\pi}{6}\right)\right) - \left(\frac{1}{7}\sin(0)\right) =$$

$$\left(\frac{1}{7}\left(\frac{1}{2}\right)\right) - \left(\frac{1}{7}(0)\right) =$$

$$\left(\frac{1}{14}\right) - (0) =$$

$$\frac{1}{14} - 0 =$$

$$\frac{1}{14} =$$

ID: 5.5.45

94. Use a change of variables or the table[4] to evaluate the following definite integral.

$$\int_0^1 15e^{3x}\,dx$$

$$= 5\int_0^1 3e^{3x}dx = 5\int_0^1 e^{3x}(3)\,dx$$

$$= 5e^{3x}\Big|_0^1$$

$$= (5e^{3(1)}) - (5e^{3(0)}).$$

[4] Click to view the table of general integration formulas.

$\int_0^1 15e^{3x}\,dx =$ ☐ (Type an exact answer.)

4: General Integration Formulas

$$\int \cos ax\,dx = \frac{1}{a}\sin ax + C$$

$$\int \sec^2 ax\,dx = \frac{1}{a}\tan ax + C$$

$$\int \sec ax \tan ax\,dx = \frac{1}{a}\sec ax + C$$

$$\int e^{ax}dx = \frac{1}{a}e^{ax} + C$$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a}\tan^{-1}\frac{x}{a} + C$$

$$\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a}\sec^{-1}\left|\frac{x}{a}\right| + C,\ a > 0$$

$$\int \sin ax\,dx = -\frac{1}{a}\cos ax + C$$

$$\int \csc^2 ax\,dx = -\frac{1}{a}\cot ax + C$$

$$\int \csc ax\ \cot ax\,dx = -\frac{1}{a}\csc ax + C$$

$$\int b^x dx = \frac{1}{\ln b}b^x + C,\ b > 0,\ b \neq 1$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\frac{x}{a} + C,\ a > 0$$

$$= (5e^3) - (5e^0)$$

$$= (5e^3) - (5(1)) =$$

$$\boxed{5e^3 - 5 =}$$

Answer: $5e^3 - 5$

ID: 5.5.46

Formula

$$\int e^{f(x)} f'(x)\,dx =$$

$$e^{f(x)} + C =$$

95. Use a change of variables or the table to evaluate the following definite integral.

$$\int_0^1 5x^4\left(3-x^5\right)dx =$$

$$= \int_0^1 (3-x^5)(5x^4)\,dx = -1\int_0^1 (3-x^5)(-5x^4)\,dx$$

$$= -1\,\frac{(3-x^5)^{1+1}}{1+1}\Big|_0^1$$

$$= -1\,\frac{(3-x^5)^2}{2}\Big|_0^1$$

5 Click to view the table of general integration formulas.

$\int_0^1 5x^4\left(3-x^5\right)dx =$ ☐ (Type an exact answer.)

5: General Integration Formulas

Formula Mr Hill

$\int \cos ax\,dx = \frac{1}{a}\sin ax + C$

$\int \sin ax\,dx = -\frac{1}{a}\cos ax + C$

$\int \sec^2 ax\,dx = \frac{1}{a}\tan ax + C$

$\int \csc^2 ax\,dx = -\frac{1}{a}\cot ax + C$

$\int \sec ax \tan ax\,dx = \frac{1}{a}\sec ax + C$

$\int \csc ax \cot ax\,dx = -\frac{1}{a}\csc ax + C$

$\int e^{ax}dx = \frac{1}{a}e^{ax} + C$

$\int b^x dx = \frac{1}{\ln b}b^x + C,\ b > 0,\ b \neq 1$

$\int \frac{dx}{a^2+x^2} = \frac{1}{a}\tan^{-1}\frac{x}{a} + C$

$\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\frac{x}{a} + C,\ a > 0$

$\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\sec^{-1}\left|\frac{x}{a}\right| + C,\ a > 0$

Formula

$$\int (f(x))^N \cdot f'(x)\,dx = \frac{(f(x))^{N+1}}{N+1} + C$$

$$-1\frac{(3-(1)^5)^2}{2} - \left(\frac{-1(3-(0)^5)^2}{2}\right) =$$

$$\left(\frac{-1(3-1)^2}{2}\right) - \left(\frac{-1(3-0)^2}{2}\right) = -\frac{4}{2} + \frac{9}{2} =$$

$$\left(\frac{-1(2)^2}{2}\right) - \left(\frac{-1(3)^2}{2}\right) =$$

$$\left(-\frac{4}{2}\right) - \left(-\frac{9}{2}\right) =$$

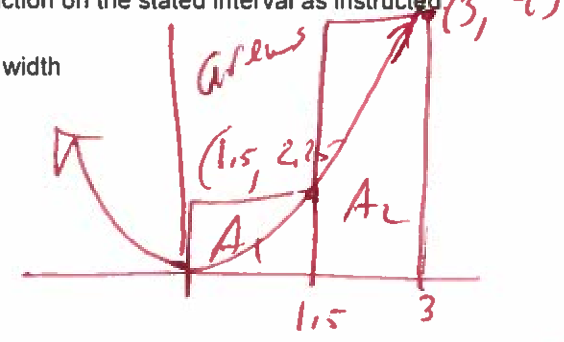
$$\frac{5}{2} = ✓$$

Answer: $\frac{5}{2}$

ID: 5.5.47

96. Use a finite approximation to estimate the area under the graph of the given function on the stated interval as instructed.

$f(x) = x^2$ between $x = 0$ and $x = 3$, using a right sum with two rectangles of equal width



○ A. 8.4375
○ B. 3.375
[✓ C. 16.875]
○ D. 12.5

$A_1 = (1.5)(2.25)$

$A_1 = 3.375$

$A_2 = (1.5)(9)$

$A_2 = 13.5$

Answer: C. 16.875

3.375
$+13.500$

16.875

ID: 5.1-1

$f(x) = x^2$

$f(1.5) = (1.5)^2 = (1.5)(1.5) = 2.25$

$f(3) = (3)^2 = (3)(3) = 9$

97. Suppose that $\int_7^8 f(x)dx = -2$. Find $\int_7^8 9f(u)du$ and $\int_7^8 -f(u)du$.

○ A. $-18; -\frac{1}{2}$

○ B. 9; 2

☑ C. −18; 2

○ D. 7; −2

Answer: C. −18; 2

ID: 5.2-12

$\int_7^8 9 f(u)\,du =$

$9\int_7^8 f(u)\,du =$

$9(-2) =$ ✓

-18

$\int_7^8 - f(u)\,du =$

$-\int_7^8 f(u)\,du =$

$-(-2) =$

$2 =$ ✓

98. Find the derivative.

$$\frac{d}{dx}\int_1^{\sqrt{x}} 16t^9\,dt$$

☑ A. $8x^{1.5}4$ ✓

○ B. $\frac{16}{5}x^{3.5} - \frac{16}{5}$

○ C. $\frac{32}{3}x^{3.5}$

○ D. $16x^{9/2}$

Answer: A. $8x^{1.5}4$

ID: 5.3-18

99. Evaluate the integral using the given substitution.

$\int x\cos\left(6x^2\right)dx,\ u = 6x^2$

$= \int \cos(6x^2)(x)\,dx$

$= \frac{1}{12}\int \cos(6x^2)(12x)\,dx$

$\frac{1}{12}\sin(6x^2) + C$

formula

$\int \cos(f(x))\cdot f'(x)\,dx$

$\sin(f(x)) + C =$

○ A. $\sin\left(6x^2\right) + C$

○ B. $\frac{1}{u}\sin(u) + C$

○ C. $\frac{1}{12}\sin\left(6x^2\right) + C$

○ D. $\frac{x^2}{2}\sin\left(6x^2\right) + C$

Answer: C. $\frac{1}{12}\sin\left(6x^2\right) + C$

ID: 5.5-1

complete square

100. Evaluate the following integral.

$\int \frac{dx}{x^2 - 2x + 37} =$

$\int \frac{dx}{x^2-2x+(\frac{1}{2}(-2))^2+37-(\frac{1}{2}(-2))^2} =$

$\int \frac{dx}{x^2-2x+(-1)^2+37-(-1)^2} =$

$\int \frac{dx}{x^2-2x+1+37-1} =$

$\int \frac{dx}{(x-1)(x-1)+36} =$

$\int \frac{dx}{(x-1)^2+(6)^2} =$

$\frac{1}{6}\tan^{-1}\left(\frac{x-1}{6}\right)+C$

$\int \frac{dx}{x^2 - 2x + 37} =$ ☐

(Use C as the arbitrary constant as needed.)

Answer: $\frac{1}{6}\tan^{-1}\frac{x-1}{6} + C$

ID: 8.1.31

101. If the general solution of a differential equation is $y(t) = Ce^{-4t} + 8$, what is the solution that satisfies the initial condition $y(0) = 3$?

$y(t) =$ ☐

Answer: $-5e^{-4t} + 8$

ID: 9.1.2

$y(t) = Ce^{-4t} + 8$

$y(0) = Ce^{-4(0)} + 8 = 3$

$= Ce^{0} + 8 = 3$

$= C(1) + 8 = 3$

$= C + 8 = 3$

$C + 8 - 8 = 3 - 8$

$C = -5$

formula

$e^0 = 1$

$y(t) = -5e^{-4t} + 8$

102. Find the general solution of the following equation. Express the solution explicitly as a function of the independent variable.

$t^{-8}y'(t) = 1$

y =

Answer: $\frac{t^9}{9} + C$

ID: 9.3.5

$$\frac{y'(t)}{t^8} = 1$$

$$\frac{y'(t)}{t^8}(t^8) = 1(t^8)$$

$$y'(t) = t^8$$

$$\int y'(t)\,dt = \int t^8\,dt$$

$$y(t) = \frac{t^{8+1}}{8+1} + C$$

$$\boxed{y(t) = \frac{t^9}{9} + C}$$

---

103. Find the general solution of the differential equation $\frac{dy}{dt} = \frac{9t^2}{8y}$.

Choose the correct answer below.

○ A. $y = \pm\sqrt{\frac{4t^3}{3} + C}$

○ B. $y = \frac{4t^3}{3} + C$

○✓ C. $y = \pm\sqrt{\frac{3t^3}{4} + C}$

○ D. $y = \frac{3t^3}{4} + C$

Answer: C. $y = \pm\sqrt{\frac{3t^3}{4} + C}$

ID: 9.3.7

$$8y\,dy = 9t^2\,dt$$

$$\int 8y\,dy = \int 9t^2\,dt$$

$$\frac{8y^{1+1}}{1+1} = \frac{9t^{2+1}}{2+1} + C_1$$

$$\frac{8y^2}{2} = \frac{9t^3}{3} + C_1$$

$$4y^2 = 3t^3 + C_1$$

$$\frac{4y^2}{4} = \frac{3t^3}{4} + \frac{C_1}{4}$$

$$y^2 = \frac{3t^3}{4} + \frac{C_1}{4}$$

$$\sqrt{y^2} = \pm\sqrt{\frac{3t^3}{4} + \frac{C_1}{4}}$$

$$\boxed{y = \pm\sqrt{\frac{3t^3}{4} + C}}$$

Let $C = \frac{C_1}{4}$

Replace upstairs

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104. The general solution of a first-order linear differential equation is $y(t) = Ce^{-9t} - 16$. What solution satisfies the initial condition y(0) = 5?

The solution is y(t) =

Answer: $21e^{-9t} - 16$

ID: 9.4.1

$$y(t)\ Ce^{-9t} - 16$$

$$y(0) = Ce^{-9(0)} - 16 = 5$$

$$Ce^0 - 16 = 5$$

$$C(1) - 16 = 5$$

$$C - 16 = 5$$

$$C - 16 + 16 = 5 + 16$$

$$C = 21$$

$$\boxed{y(t) = 21e^{-9t} - 16}$$

105. Find the general solution of the following equation.

$y'(t) = 5y - 4$

$y(t) =$

(Use C as the arbitrary constant.)

Answer: $Ce^{5t} + \frac{4}{5}$

ID: 9.4.5

first order linear differential Equation

formula

$y'(t) = ky + b$

$y(t) = Ce^{kt} - \frac{b}{k}$

$k = 5$

$b = -4$

$y'(t) = 5y - 4$

$y(t) = Ce^{5t} + \frac{-4}{5}$

$y(t) = Ce^{5t} + \frac{4}{5}$ ✓