Name:

Find the open interval where the function $f(x) = \frac{1}{3}x^3 - 3x^2 + 5x - 7$ is concave down.

1.A◯ $(5, \infty)$

B◯ $(1, 5)$

C◯ $(1, \infty)$

D◯ $(-\infty, 1)$

E◯ $(-\infty, 3)$

F◯ $(3, \infty)$

Find the x-coordinate of the inflection point of $y = e^{2x} - 8x^2$.

2.A◯ $x = e^2$

B◯ $x = \frac{1}{2}\ln 4$

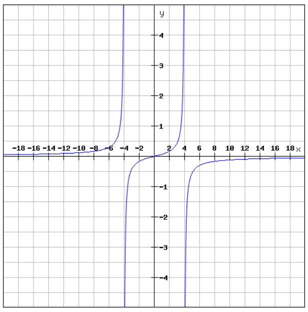
C◯ $x = 0$

D◯ $x = \ln 4$

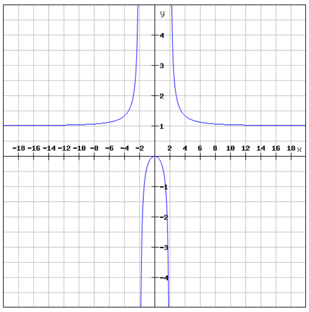
E◯ $x = 2\ln 4$

F◯ $x = e$

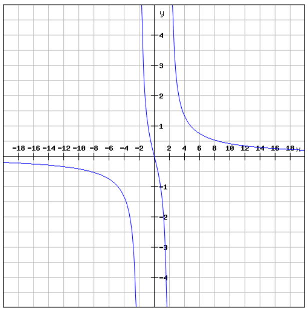
Given the function $f(x) = \dfrac{4x}{x^2-4}$ with its first and second derivatives $f'(x) = \dfrac{-4(x^2+4)}{(x^2-4)^2}$ and $f''(x) = \dfrac{8x(x^2+12)}{(x^2-4)^3}$.
Find the graph of $f(x)$.



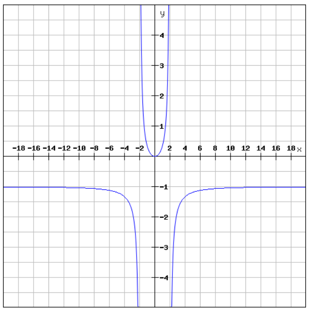
3.A◯



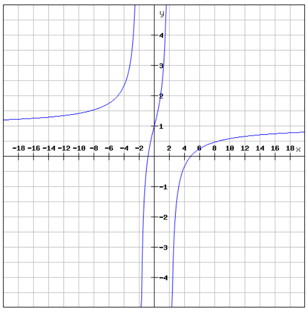
B◯



C◯



D◯



E◯

Let $f(x)$ be a polynomial whose derivative is always increasing. Choose the correct statement(s).

[I.] $f(x)$ has an inflection point.

[II.]$f(x)$ has a relative maximum.

[III.] $f(x)$ is always concave up.

4.A◯ Only I is correct.

B◯ Only II is correct.

C◯ Only III is correct.

D◯ I and II are correct.

E◯ II and III are correct.

F◯ I and III are correct.

Which of the following limits equals to $-\infty$?

5.A◯ $\lim\limits_{x\to-\infty} \dfrac{1-x^2}{x-1}$

B◯ $\lim\limits_{x\to-\infty} \dfrac{2x^2}{x^2+2}$

C◯ $\lim\limits_{x\to\infty} \dfrac{x^3-1}{x^2+1}$

D◯ $\lim\limits_{x\to\infty} \dfrac{-x^3+2x^2-3x}{3x^4-5x^3+1}$

E◯ $\lim\limits_{x\to\infty} \left(\dfrac{2}{x}-\dfrac{x}{6}\right)$

F◯ $\lim\limits_{x\to\infty} \dfrac{x-1}{x^3-1}$

Consider the function $f(x) = \dfrac{x^2+3x+2}{x^2-1}$. Which of the statements are true?

[I.] f has a vertical asymptote at $x = 1$.

[II.] f has a horizontal asymptote at $y = 0$.

[III.] f has a vertical asymptote at $x = -1$.

[IV.] f has a horizontal asymptote at $y = 1$.

6.A◯ I and II

B◯ I and III

C◯ II and IV

D◯ III and IV

E◯ I and IV

F◯ II and III

An open-top box with a square base is made using 48 ft^2 of material. Find the maximum possible volume of this box.

7.A◯ 64 ft^3

B◯ 80 ft^3

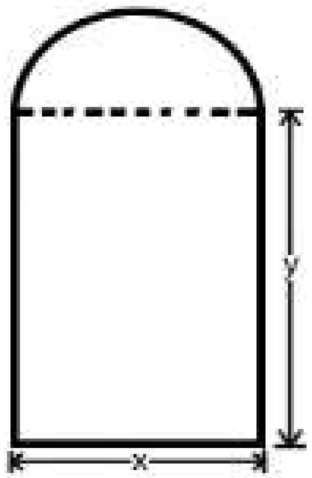
C◯ 32 ft^3

D◯ 96 ft^3

E◯ 16 ft^3

F◯ 48 ft^3

Norman window is constructed by adjoining a semicircle to the top of an ordinary rectangular window. See figure below. Find x which maximizes the area of this window if the total perimeter is 10 feet.



8.A◯ $\dfrac{10}{(\pi+2)^2}$ ft

B◯ $\dfrac{20}{(\pi+4)^2}$ ft

C◯ $\dfrac{10}{\pi}$ ft

D◯ $\dfrac{20}{\pi+4}$ ft

E◯ $\dfrac{20}{\pi+2}$ ft

F◯ $\dfrac{20}{\pi}$ ft

Find the x-coordinate of the point on the graph of $y = \sqrt{x} + 2$ that is the closest to the point $(3, 2)$.

9.A◯ 0

B◯ $\frac{1}{2}$

C◯ $\frac{7}{2}$

D◯ $\frac{5}{2}$

E◯ $\frac{3}{2}$

F◯ $\frac{9}{2}$

SheSellsSeaShells is an ocean boutique offering shells and handmade shell crafts on Sanibel Island in Florida. Find the price SheSellsSeaShells should charge to maximize revenue if $p(x) = 160 - 2x$, where $p(x)$ is the price in dollars at which x shells will be sold per day.

10.A◯ \$60

B◯ \$100

C◯ \$40

D◯ \$80

E◯ \$120

F◯ \$20

Find the open interval where $f(x) = \frac{1}{2}x^4 + 2x^3$ is concave downward.

11.A◯ $(-\infty, -3)$

B◯ $(-3, 0)$

C◯ $(-3, -2)$

D◯ $(-2, \infty)$

E◯ $(-2, 0)$

F◯ $(-3, \infty)$

Let $f(x) = -x^3 + 12x$. The y values of the absolute minimum and the absolute maximum of $f(x)$ over the closed interval $[-3, 5]$ are respectively:

12.A◯ -16 and -9

B◯ -65 and -9

C◯ -9 and 16

D◯ -65 and 16

E◯ -65 and -16

F◯ -16 and 16

$\lim_{x\to\infty} f(x) = \infty$ is true for which of the following functions?

13.A◯ $f(x) = \dfrac{x - x^2}{-x + 5}$

B◯ $f(x) = \dfrac{2x^3 + x^2 - 2}{-3x^3 + 7}$

C◯ $f(x) = \dfrac{x^3 + x^2 - 2}{-x + 5}$

D◯ $f(x) = \dfrac{2}{x} + 3$

E◯ $f(x) = \dfrac{x + 9}{x^2 + x + 6}$

F◯ $f(x) = \dfrac{2x^2}{x^2 + x}$

Choose the correct statement regarding the asymptotes of $f(x)$.

$f(x) = \dfrac{x^2 - 2x + 6}{x + 1}$

14.A◯ Horizontal Asymptote: $y = -1$; Vertical Asymptote: $x = 1$; Slant Asymptote: None

B◯ Horizontal Asymptote: $y = -1$; Vertical Asymptote: $x = 1$; Slant Asymptote: $y = x - 3$

C◯ Horizontal Asymptote: $y = 0$; Vertical Asymptote: $x = 1$; Slant Asymptote: $y = x - 3$

D◯ Horizontal Asymptote: None; Vertical Asymptote: $x = -1$; Slant Asymptote: None

E◯ Horizontal Asymptote: $y = 0$; Vertical Asymptote: $x = -1$; Slant Asymptote: None

F◯ Horizontal Asymptote: None; Vertical Asymptote: $x = -1$; Slant Asymptote: $y = x - 3$

Find the point on the graph of $y = 5x + 2$ that is the closest to the point (0,4).

15.A◯ $(\frac{5}{13}, \frac{51}{13})$

B◯ $(\frac{5}{13}, \frac{51}{26})$

C◯ $(\frac{10}{13}, \frac{51}{13})$

D◯ $(\frac{5}{26}, \frac{51}{13})$

E◯ $(\frac{5}{13}, \frac{102}{13})$

F◯ $(\frac{10}{13}, \frac{102}{13})$

$f(x)$ is a polynomial and

$$f'(2) = 0, \qquad f'(5) = 0$$

$$f''(3.5) = 0,\ f''(x) < 0 \text{ on } (-\infty, 3.5) \text{ and } f''(x) > 0 \text{ on } (3.5, \infty)$$

Which of the following statements are true?

I. $(2, f(2))$ is an inflection point of $f(x)$.

II. $(3.5, f(3.5))$ is an inflection point of $f(x)$.

III. $f(x)$ has a relative maximum at $x = 2$.

IV. $f(x)$ has a relative minimum at $x = 5$.

16.A◯ Only I and III are true.

B◯ Only II and IV are true.

C◯ Only I, II and IV are true.

D◯ Only II and III are true.

E◯ Only II, III and IV are true.

F◯ Only I and IV are true.

$$\int \frac{\sin x - 2\cos x}{4} \mathrm{d}x =$$

17.A◯ $\dfrac{\sin x + 2\cos x}{4} + C$

B◯ $\dfrac{2\sin x - \cos x}{4} + C$

C◯ $\dfrac{-2\sin x - \cos x}{4} + C$

D◯ $\dfrac{2\sin x + \cos x}{4} + C$

E◯ $\dfrac{-2\sin x + 2\cos x}{4} + C$

F◯ $\dfrac{-\sin x + 2\cos x}{4} + C$

An evergreen nursery usually sells a certain shrub after 5 years of growth and shaping. The growth rate during those 5 years is approximated by

$$\frac{\mathrm{d}h}{\mathrm{d}t} = 1.4t + 8,$$

where t is the time in years and h is the height in centimeters. The seedlings are 14 centimeters tall when planted. How tall are the shrubs when they are sold?

18.A◯ 42 cm

B◯ 71.5 cm

C◯ 29 cm

D◯ 36 cm

E◯ 57.5 cm

F◯ 92.5 cm

A company's marketing department has determined that if their product is sold at the price of p dollars per unit, they can sell $q = 2800 - 200p$ units. Each unit costs \$10 to make. What is the maximum profit that the company can make?

19.A◯ 800 dollars

B◯ 600 dollars

C◯ 1200 dollars

D◯ 880 dollars

E◯ 1000 dollars

F◯ 980 dollars

Find the absolute extrema of $f(x) = 2x^3 + 3x^2 - 36x$ on the closed interval $[0, 4]$.

20.A◯ absolute minimum: $(2, -44)$; absolute maximum: $(0, 0)$

B◯ absolute minimum: $(0, 0)$; absolute maximum: $(4, 32)$

C◯ absolute minimum: $(-3, 0)$; absolute maximum: $(0, 0)$

D◯ absolute minimum: $(2, -44)$; absolute maximum: $(4, 32)$

E◯ absolute minimum: $(2, -44)$; absolute maximum: $(-3, 81)$

F◯ absolute minimum: $(-3, 0)$; absolute maximum: $(2, 0)$

A rectangular plot of farmland will be bounded on one side by a river and on the other three sides by a single-strand electric fence. With 160 m of wire at your disposal, what is the **largest area** you can enclose?

21.A◯ $6400\,\mathrm{m}^2$

B◯ $3200\,\mathrm{m}^2$

C◯ $1600\,\mathrm{m}^2$

D◯ $3600\,\mathrm{m}^2$

E◯ $4000\,\mathrm{m}^2$

F◯ $4800\,\mathrm{m}^2$

A rectangular box with square base and top is to be constructed using sturdy metal. The volume is to be 16 m^3. The material used for the sides costs \$4 per square meter, and the material used for the top and bottom costs \$1 per square meter. What is the least amount of money that can be spent to construct the box?

22.A◯ \$96

B◯ \$160

C◯ \$30

D◯ \$55

E◯ \$120

F◯ \$136

Choose the correct statement(s) about the function $f(x) = 2x^3 - 9x^2$.

[I.]$f(x)$ has a relative maximum at $x = 0$.

[II.] $f(x)$ has a relative minimum at $x = 3$.

[III.] $f(x)$ is concave downward on $(-\infty, \frac{3}{2})$.

23.A◯ I only

B◯ II only

C◯ I & III only

D◯ II & III only

E◯ All of the statements are true.

F◯ I & II only

Find the point of inflection of $h(x) = xe^{-2x}$.

24.A◯ $\left(\frac{1}{2}, \frac{e}{2}\right)$

B◯ $\left(-1, -e^2\right)$

C◯ $\left(-\frac{1}{2}, -\frac{e}{2}\right)$

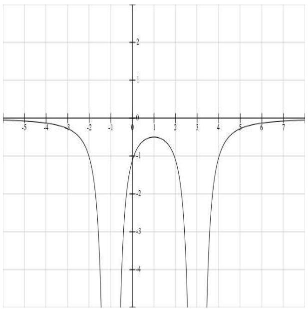
D◯ $\left(\frac{1}{2}, \frac{1}{2e}\right)$

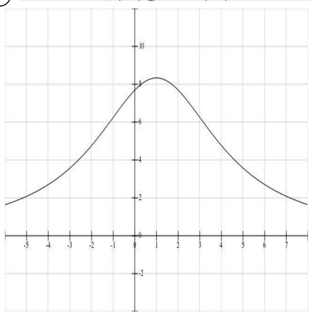
E◯ $(0, 0)$

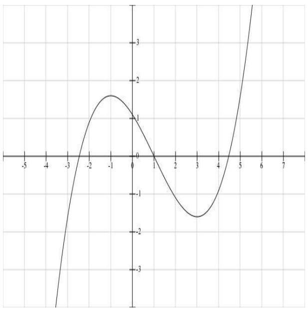
F◯ $\left(1, \frac{1}{e^2}\right)$

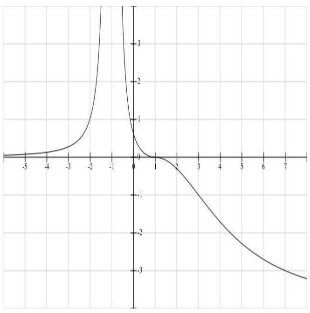
A function $f(x)$ satisfies the following conditions:
$f'(x) > 0$ on $(-\infty, -1)$
$f''(x) < 0$ on $(-1, 0)$
$f'(x) = 0$ at $x = 1$

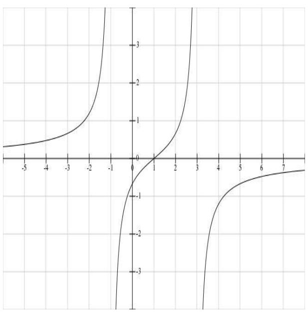
Which of the following graphs is a possible graph of $f(x)$?

25.A ◯ 

B ◯ 

C ◯ 

D ◯ 

E ◯ 

Celeste wants to build a fence to enclose a rectangular area of 600 square feet near a stream. The side of the enclosure next to the stream will be made of a waterproof fencing. The other three sides will be made of wood fencing. The waterproof fencing costs \$20 per foot, and the wood fencing costs \$10 per foot. What is the minimum total cost for the fencing?

26.A◯ \$2300

B◯ \$1200

C◯ \$600

D◯ \$900

E◯ \$1300

F◯ \$1800

Which of the following describes all the asymptotes of the function $f(x) = \dfrac{-2x^2 - 5x + 7}{x + 3}$?

27.A◯ $x = -3, y = -2x + 1$

B◯ $x = 3, y = -2$

C◯ $x = -3, y = -2$

D◯ $x = -2, y = 0$

E◯ $x = -2, y = 2x + 1$

F◯ $x = 3, y = 0$

A box with a square base and open top is to be made from 300 square inches of material. What is the volume of the largest box that can be made.

28.A◯ 600 cubic inches

B◯ 500 cubic inches

C◯ 400 cubic inches

D◯ 472 cubic inches

E◯ 560 cubic inches

F◯ 532 cubic inches

A poster is to have an area of 200 square inches with 1 inch margins on the left and right sides, and 2 inch margins on the top and bottom. Varying the dimensions of the poster changes the area of the region inside the margins. What is the maximum area inside the margins?

29.A◯ 88 square inches

B◯ 108 square inches

C◯ 168 square inches

D◯ 138 square inches

E◯ 148 square inches

F◯ 128 square inches

$$\int \frac{3x^2-4}{2\sqrt{x}}dx =$$

30.A◯ $\frac{3}{4}\sqrt{x^3} - \frac{3}{\sqrt{x}} + C$

B◯ $\frac{9}{4}\sqrt{x^5} + \sqrt{x} + C$

C◯ $\frac{3}{5}\sqrt{x^3} - \frac{4}{3}\sqrt{x} + C$

D◯ $\frac{3}{5}\sqrt{x^5} - 4\sqrt{x} + C$

E◯ $\frac{3}{7}\sqrt{x^7} - \frac{4}{3}\sqrt{x^3} + C$

F◯ $\frac{9}{4}\sqrt{x} + \frac{1}{\sqrt{x^3}} + C$

Find the particular solution that satisfies the following differential equation and the initial conditions.

$$f''(x) = 3\cos(x), \quad f'(0) = 4, \quad f(0) = 7$$

31.A◯ $f(x) = 3\cos(x) + 4x + 10$

B◯ $f(x) = -3\cos(x) + 4x + 10$

C◯ $f(x) = 3\cos(x) + 4x + 7$

D◯ $f(x) = 3\cos(x) + x + 7$

E◯ $f(x) = -3\cos(x) + 4x + 7$

F◯ $f(x) = -3\cos(x) + x + 7$

Find the inflection point of $y = x^3 + 3x^2$.

32.A◯ $(-2, 4)$

B◯ $(0, 2)$

C◯ $(-1, 2)$

D◯ $(-1, 0)$

E◯ $(-2, 0)$

F◯ $(0, 0)$

A particle is moving on a straight line with an initial velocity of 10 ft/sec and an acceleration of

$$a(t) = \sqrt{t} + 2,$$

where t is time in seconds and $a(t)$ is in ft/sec^2. What is its velocity after 9 seconds?

33.A◯ 72 ft/sec

B◯ 135 ft/sec

C◯ 24 ft/sec

D◯ 46 ft/sec

E◯ 90 ft/sec

F◯ 140 ft/sec

Which of the following limits equals $-\infty$?

34.A◯ $\displaystyle\lim_{x \to -\infty} \frac{-2x^2 + 7x}{x^3 + 5x^2 + 1}$

B◯ $\displaystyle\lim_{x \to -\infty} \frac{x^2 - 4}{x^2 + 1}$

C◯ $\displaystyle\lim_{x \to -\infty} \frac{-x^3 + 8}{x^2 + x - 2}$

D◯ $\displaystyle\lim_{x \to -\infty} \frac{x^3 + 5x^2 - 7x}{-2x^2 - 5x + 6}$

E◯ $\displaystyle\lim_{x \to -\infty} \frac{x^4 + 8x}{x^3 + 1}$

F◯ $\displaystyle\lim_{x \to -\infty} \frac{x^2 + 4x - 5}{x^4 - 1}$

Choose the correct statement regarding the y values of the absolute maximum and the absolute minimum of $f(x) = x^3 - 3x + 10$ on the interval of $[0, 3]$.

35.A◯ The y values of the absolute maximum and the absolute minimum are 28 and 10 respectively.

B◯ The y values of the absolute maximum and the absolute minimum are 12 and 12 respectively.

C◯ The y values of the absolute maximum and the absolute minimum are 28 and 8 respectively.

D◯ The y values of the absolute maximum and the absolute minimum are 12 and 10 respectively.

E◯ The y values of the absolute maximum and the absolute minimum are 28 and 12 respectively.

F◯ The y values of the absolute maximum and the absolute minimum are 12 and 8 respectively.

Find the x values at which the inflection points of $f(x) = \frac{1}{4}x^4 + \frac{2}{3}x^3 - \frac{15}{2}x^2 + 7$ occur.

36.A◯ $x = -5$ and $x = -3$

B◯ $x = -3$ and $x = \frac{5}{3}$

C◯ $x = 0$ and $x = 3$

D◯ $x = -5$ and $x = 3$

E◯ $x = -3$ and $x = 0$

F◯ $x = 0$ and $x = \frac{5}{3}$

Find the largest open interval(s) where $f(x) = 4x^5 - 5x^4$ is concave upward.

37.A◯ $(-\infty, \frac{3}{4})$

B◯ $(-\infty, \frac{3}{4})$ and $(1, \infty)$

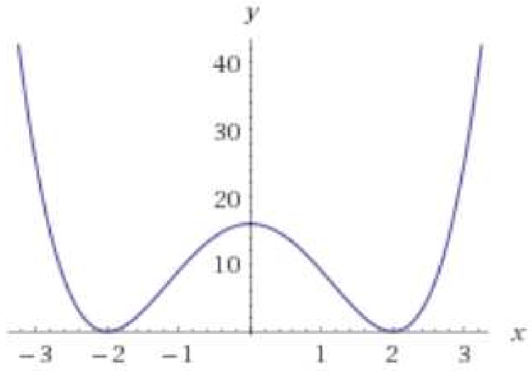
C◯ $(-\infty, 0)$ and $(1, \infty)$

D◯ $(-\infty, 0)$ and $(\frac{3}{4}, \infty)$

E◯ $(\frac{3}{4}, \infty)$

F◯ $(0, \infty)$

The following graph is of $f'(x)$. Choose the correct statement(s) about $f(x)$.



I. On $(-2, 2)$, $f(x)$ is increasing.

II. On $(-\infty, -2)$, $f(x)$ is concave up.

III. $f(x)$ has a relative maximum at $x = 0$.

38.A◯ I, II only

B◯ II only

C◯ II, III only

D◯ I,III only

E◯ III only

F◯ I only

Evaluate the indefinite integral $\int \sec x(\tan x - \sec x)\ dx$.

39.A◯ $-\sec x + \tan x + C$

B◯ $\sec x + \cot x + C$

C◯ $\sec x - \tan x + C$

D◯ $-\sec x - \tan x + C$

E◯ $\csc x + \tan x + C$

F◯ $\sec x + \tan x + C$

Solve the following initial value problem

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

40.A ◯ $y = -\frac{2}{x^3} + \frac{x^2}{2} + \frac{7}{2}$

B ◯ $y = -\frac{1}{x} + \frac{x^2}{2} + \frac{5}{2}$

C ◯ $y = -\frac{1}{x} + \frac{x^2}{2} - \frac{1}{2}$

D ◯ $y = -\frac{2}{x^3} + 4$

E ◯ $y = -\frac{2}{x^3} + \frac{x^2}{2} - \frac{3}{4}$

F ◯ $y = -\frac{1}{x} + \frac{x^2}{2} + \frac{1}{2}$

Suppose the derivative of $f(x)$ is $f'(x) = x^3 + 27$. Determine on which interval $f(x)$ is decreasing.

41.A ◯ $(3, \infty)$

B ◯ $(-\infty, 3)$

C ◯ $(0, \infty)$

D ◯ $(-3, \infty)$

E ◯ $(-\infty, -3)$

F ◯ $(-\infty, 0)$

A family wants to fence a rectangular play area alongside the wall of their house. The wall of their house bounds one side of the play area. If they want the play area to be exactly 2500 ft^2, what is the least amount of fencing needed? Round your answer to the nearest tenth place.

42.A ◯ 141.4 ft

B ◯ 186.6 ft

C ◯ 70.7 ft

D ◯ 106.1 ft

E ◯ 212.1 ft

F ◯ 93.3 ft

A box with a square base and an open top must have a volume of 4000 cm^3. If the cost of the material used is \$1 per cm^2, the smallest possible cost of the box is

43.A◯ \$1500

B◯ \$500

C◯ \$1000

D◯ \$2000

E◯ \$600

F◯ \$1200

Find the x-coordinate of the absolute maximum of $g(x) = x^3 - 3x^2 + 12$ on the closed interval $[-2, 4]$.

44.A◯ 4

B◯ 3

C◯ 2

D◯ 0

E◯ 1

F◯ -2

Which of the following is/are true:

I. $\lim\limits_{x\to\infty} \dfrac{-12x^8 + 4x^2}{6x^5 + 6} = -\infty$

II. $\lim\limits_{x\to\infty} \dfrac{10x^3 + 100x + 1000}{-5x^3 + x^2 + x + 1} = -\dfrac{1}{2}$

III. $\lim\limits_{x\to\infty} \dfrac{14x^6 + 3}{x^7 + x^9} = 14$

45.A◯ II and III only.

B◯ I and III only.

C◯ I, II and III.

D◯ I only.

E◯ III only.

F◯ II only.

Find the slant asymptote of $h(x) = \dfrac{3x^3 + 11x^2 + 16x + 9}{x^2 + 2x + 1}$.

46.A◯ $y = 3x + 5$

B◯ $y = 3x$

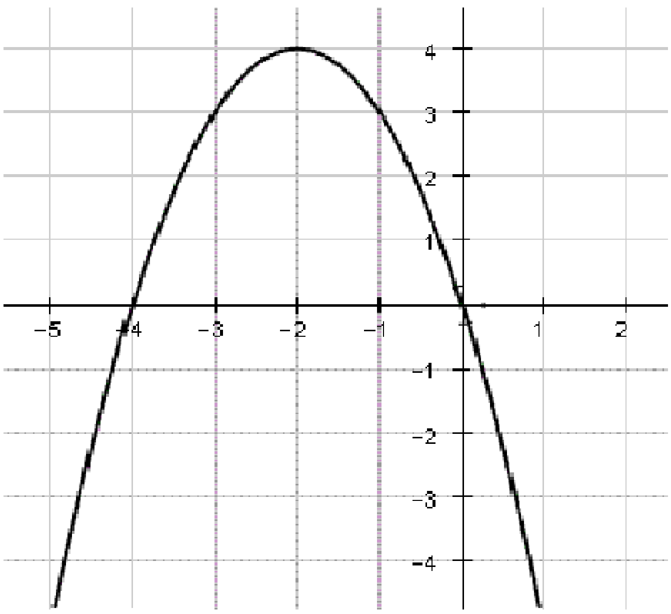
C◯ $y = 2x + 11$

D◯ $y = 11x + 4$

E◯ $y = 2x + 1$

F◯ $y = 11x$

The graph of $f'(x)$ is given. Find the x-value of any inflection point(s) of $f(x)$.



47.A◯ 0 only

B◯ -4 and 0 only

C◯ -2 only

D◯ -4, -2 and 0 only

E◯ -4 only

F◯ 4 only

$$\int \frac{4\sqrt[3]{x^2}-2}{x}\,\mathrm{d}x =$$

48.A◯ $6x^{\frac{2}{3}} - 2 + C$

B◯ $6x^{\frac{1}{2}} - \frac{2}{x^2} + C$

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

D◯ $9x^{\frac{3}{2}} - 2\ln|x| + C$

E◯ $6x^{\frac{2}{3}} - 2\ln|x| + C$

F◯ $9x^{\frac{3}{2}} - 2 + C$

Consider the function:

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

Consider the following statements:

I. f does not have a horizontal asymptote.

II. f has a vertical asymptote at $x = 3$.

III. The x-intercept of f is $(-1, 0)$.

Which of those statements is/are **TRUE**?

49.A◯ All of them

B◯ I and III only

C◯ III only

D◯ I only

E◯ II only

F◯ I and II only

A (closed) rectangular box with a square base will be built for \$48. The material for the top and bottom of the box costs \$2 per square foot, and the material for the sides of the box costs \$1 per square foot. What is the volume of the largest box that can be made?

50.A◯ 8 cubic feet

B◯ 32 cubic feet

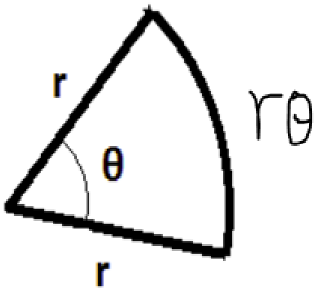
C◯ 24 cubic feet

D◯ 2 cubic feet

E◯ 4 cubic feet

F◯ 16 cubic feet

A circular sector with radius r and angle θ in radians as shown below has an enclosed area of $A = \frac{1}{2}r^2\theta$. The length of the circular arc is $r\theta$. What is the maximum possible area if the perimeter of such a circular sector is 10?



51.A◯ 2.5

B◯ 8.25

C◯ 12.5

D◯ 10.5

E◯ 6.25

F◯ 3.125

Consider $f(x) = \frac{1}{6}x^3 + 4x - 1$ and $g(x) = x^3 - 6x^2 - 7x + 23$. On which interval(s) are both $f(x)$ and $g(x)$ concave up?

52.A◯ $(-\infty, 2)$

B◯ $(2, \infty)$

C◯ $(-\infty, 0) \cup (2, \infty)$

D◯ $(0, 2)$

E◯ $(-\infty, 0)$

F◯ $(0, \infty)$

Find all the asymptotes of $f(x) = \dfrac{1 - 2x - x^2}{x + 4}$.

53.A◯ Vertical: $x = -4$; Horizontal: $y = 0$; Slant: $y = -x + 2$

B◯ Vertical: $x = 4$; Horizontal: $y = 0$; Slant: NONE

C◯ Vertical: $x = -4$; Horizontal: NONE; Slant: $y = -x + 2$

D◯ Vertical: $x = -4$; Horizontal: NONE; Slant: NONE

E◯ Vertical: $x = 4$; Horizontal: NONE; Slant: $y = -x + 2$

F◯ Vertical: $x = 4$; Horizontal: $y = 0$; Slant: $y = -x + 2$

Solve the initial value problem $y' = 2\sin x + 4$ with $y(0) = 1$.

54.A◯ $y = -2\cos x + 4x$

B◯ $y = 2\cos x + 4x$

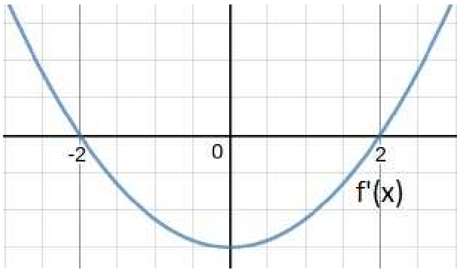
C◯ $y = -2\cos x + 4x - 1$

D◯ $y = -2\cos x + 4x + 3$

E◯ $y = 2\cos x + 4x - 1$

F◯ $y = 2\cos x + 4x + 3$

A graph of the **derivative**, $f'(x)$, of a function $f(x)$, is shown below. Choose the correct statement(s).



[I] $f(x)$ is increasing on $(0, \infty)$.

[II] $f(x)$ is concave down on $(-\infty, 0)$.

[III] $f(x)$ is decreasing on $(-2, 2)$.

[IV] $f(x)$ has a relative minimum at $x = -2$.

55.A◯ III and IV

B◯ II and III

C◯ Only I

D◯ I and II

E◯ I and III

F◯ II and IV

Evaluate the indefinite integral $\int \csc x(\cot x - \csc x)\; dx$.

56.A◯ $\cot x + \csc x + C$

B◯ $\cot x \csc x + C$

C◯ $\csc x - \cot x + C$

D◯ $2 \cot x \csc x + C$

E◯ $-\cot x - \csc x + C$

F◯ $\cot x - \csc x + C$

Find the decreasing and concave down interval(s) of $f(x) = xe^{-x}$.

57.A◯ $(1, 2)$

B◯ $(2, \infty)$

C◯ $(-\infty, 2)$

D◯ $(1, \infty)$

E◯ $(-\infty, 1) \cup (2, \infty)$

F◯ $(-\infty, 1)$

Solve the initial value problem $y'' = 2 + 4e^x$ with $y'(0) = 1$ and $y(0) = 4$.

58.A◯ $y = x^2 + 4e^x - 3x$

B◯ $y = x^2 + 4e^x - 4x + 3$

C◯ $y = x^2 + 4e^x - 4$

D◯ $y = 8e^{2x}$

E◯ $y = x^2 + 4e^x - 3x - 4$

F◯ $y = 8e^{2x} + 2x$

For rectangles that have a fixed perimeter of 34, what is the largest possible area?

59.A◯ 80.10

B◯ 61.10

C◯ 72.25

D◯ 77.06

E◯ 52.25

F◯ 68.06

A company would like to make a cylindrical can to hold exactly 250π cm^3. What radius will minimize the amount of material needed to construct the can? Recall the volume of a cylinder is given by $V = \pi r^2 h$ and the surface area is given by $A = 2\pi r^2 + 2\pi r h$.

60.**A**◯ 5 cm

B◯ 10 cm

C◯ 7.94 cm

D◯ 3.97 cm

E◯ 15.71 cm

F◯ 33.42 cm