1) Determine the domain of the function $f(x) = 1/\sqrt{4x - 4}$ 1) ________

A) $(-\infty, 1]$

B) $(-\infty, 1)$

C) $[-1, \infty)$

D) $(1, \infty)$

E) $[1, \infty)$

2) $\lim_{x \to 2} \frac{x^2 + 4x - 12}{x^2 - 4}$ 2) ________

A) Does not exist

B) 0

C) 2

D) -1

E) 1

3) $\lim_{x \to \infty} \frac{7x + 8}{3x^2 + 7x - 5}$ 3) ________

A) $\frac{7}{3}$

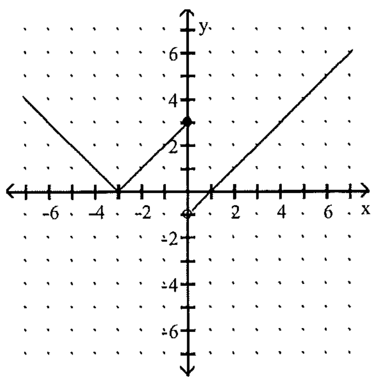
B) $-\frac{8}{5}$

C) $-\frac{12}{5}$

D) Does not exist

E) 0

4) 4) ______



The graph of y = f(x) is shown above. Use the graph to answer the questions.
Where does f(x) fail to be continuous? Where does f(x) fail to be differentiable?

A) discontinuos at x=0; differentiable everywhere

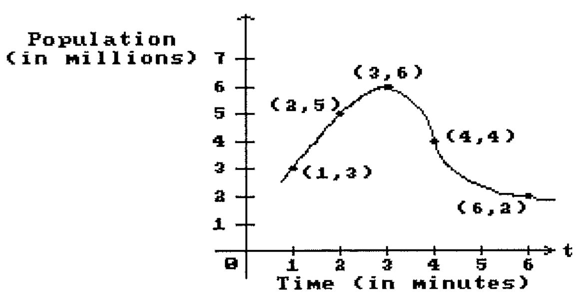
B) discontinuos at x=0; not differentiable at x=0, -3

C) discontinuos at x=-3; not differentiable at x=0

D) discontinuos at x=0; not differentiable at x=-3

E) continuos everywhere; not differentiable at x=0

5) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. Find the average rate of change of population with respect to time as t changes from 1 to 3 minutes. 5) ______



A) $\frac{2}{3}$ million per minute

B) $\frac{3}{2}$ million per minute

C) 1 million per minute

D) 5 million per minute

E) 2 million per minute

6) Differentiate $y = \frac{6 \cos x}{1 + \sin x}$ 6) ________

A) $\frac{-6 \sin x + 6 \cos^2 x - 6 \sin^2 x}{(1 + \sin x)^2}$

B) $-\frac{6}{1 + \sin x}$

C) $-\frac{6 \sin x + 6 \cos^2 x}{(1 + \sin x)^2}$

D) $-\frac{\sin x}{\cos x}$

E) $-\frac{6 (1 + \cos x)}{1 + \sin x}$

7) Differentiate $f(x) = \ln\left(\frac{x^4 + 3}{x}\right)$ 7) ________

A) $\frac{4x^3}{x^4 + 3}$

B) $\frac{3x^4 - 3}{x(x^4 + 3)}$

C) $\frac{x}{x^4 + 3}$

D) $\frac{4x^3 - 1}{x(x^4 + 3)}$

E) $\frac{4x^4}{x^4+3}$

8) Differentiate $f(x) = x^5 e^{-x}$ 8) ________

A) $x^4 e^{-x}(5 - x)$

B) $x^4 e^{-x}(x + 5)$

C) $-x^4 e^{-x}(x + 5)$

D) $x^4 e^{-x}(5x - 1)$

E) $-5 x^4 e^{-x}$

9) Find the equation of the line tangent to the graph of the function $y = 2 \sin 2x$ at $x = 0$ 9) ________

A) $y = -2x$

B) $y = 2x - 2$

C) $y = -4x + 2$

D) $y = 4x+1$

E) $y = 4x$

10) A balloon used in surgical procedures is cylindrical in shape. As it expands outward, assume that the length remains a constant 80.0 mm. Find the rate of change of surface area with respect to radius when the radius is 0.080 mm. The surface area is given by the formula $S(r,l) = 2\pi rl + 2\pi r^2$, where l is the length and r is the radius. (Answer can be left in terms of π). 10) ______

A) $80.16\,\pi\ mm^2/mm$

B) $160.48\,\pi\ mm^2/mm$

C) $160.0\,\pi\ mm^2/mm$

D) $160.32\,\pi\ mm^2/mm$

E) $80.32\,\pi\ mm^2/mm$

11) Given the distance function, $s(t) = 2t^3 - 3t^2 - 66t$, where s is in meters and t is in seconds, find all times when the acceleration is 6 m/sec^2. 11) ______

A) $t = -4, -204$ sec

B) $t = 1/2$ sec

C) $t = 1$ sec

D) $t = 0, -3$ sec

E) $t = 4, -3$ sec

12) Calculate dy/dt for the implicit function: $xy + x = 12$ at (2, 5) given information $dx/dt = -3$ when $x = 2, y = 5$ 12) ______

A) 3

B) 9

C) -3

D) 21

E) -9

13) Find the relative extrema of the function $f(x) = x^3 - 3x^2 + 1$, if they exist. 13) ______

A) None

B) (0,0), (2,0)

C) (0, 1), (2, -3)

D) (2, -3)

E) (0, 1)

14) Find the points of inflection of $f(x) = 3x + \cos 2x$, if they exist. 14) _______

A) $\frac{\pi}{2} + \frac{n\pi}{2}$

B) $\frac{\pi}{4} + \frac{n\pi}{2}$

C) $\frac{\pi}{2} + n\pi$

D) $\frac{\pi}{4} + n\pi$

E) Trignometric functions do not have inflection points.

15) Find the absolute maximum and absolute minimum values of the function $f(x) = \frac{x^2}{2 + x}$, if they exist, on the indicated interval [0, 4]. 15) _______

A) Absolute maximum: $\frac{8}{3}$, absolute minimum: 1

B) Absolute maximum: 0, absolute minimum: −4

C) Absolute maximum: 2, absolute minimum: −8

D) Absolute maximum: 1, absolute minimum: 0

E) Absolute maximum: $\frac{8}{3}$, absolute minimum: 0

16) Suppose that the cost C of removing p% of the pollutants from a chemical dumping site is given by 16) ______

$C(p) = \frac{\$20,000}{100 - p}$.

Can a company afford to remove 100% of the pollutants? Explain.

A) Yes, the cost of removing 100% of the pollutants is $200, which is certainly affordable.

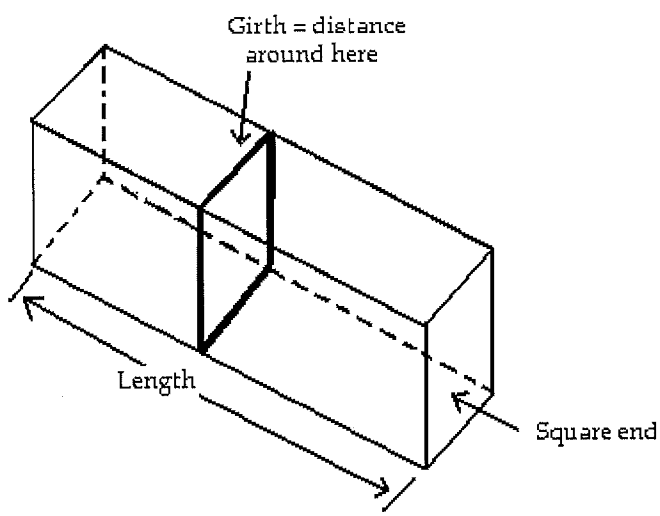
B) No, the cost of removing 100% of the pollutants is $2,000,000, which is a prohibitive amount of money.

C) Yes, the cost of removing p% of the pollutants goes to zero as p approaches 100.

D) No, the cost of removing p% of the pollutants increases without bound as p approaches 100.

E) Yes, the cost of removing 100% of the pollutants approaches $20,000, which is still affordable.

17) A private shipping company will accept a box for domestic shipment only if the sum of its length and girth (distance around) does not exceed 120 in. What dimensions will give a box with a square end the largest possible volume? 17) ______



A) 40 in. x 40 in. x 40 in.

B) 20 in. x 40 in. x 40 in.

C) 20 in. x 20 in. x 100 in.

D) 10 in. x 10 in. x 80 in.

E) 20 in. x 20 in. x 40 in.

18) Find the linearization of $f(x) = \sqrt{5x + 9}$ at $a = 0$ 18) ______

A) $\frac{5}{3}x + 3$

B) $\frac{1}{6}x + 3$

C) $\frac{5}{3}x - 3$

D) $\frac{5}{6}x - 3$

E) $\frac{5}{6}x + 3$

19) The natural resources of an island limit the growth of the population. The population of the island is given by the logistic equation 19) ______

$$P(t) = \frac{2888}{1 + 3.73e^{-0.35t}}$$

where t is the number of years after 1980. What is the maximum value of the population?

A) 796

B) 2888

C) 3624

D) 16

E) 611

20) A certain radioactive isotope has a half-life of approximately 2000 years. How many years to the nearest year would be required for a given amount of this isotope to decay to 60% of that amount? 20) ______

A) 1474 yr

B) 11813 yr

C) 2644 yr

D) 800 yr

E) 1414 yr

21) Evaluate $\int (e^{2x} + \cos 5t)\, dt$ 21) ______

A) $e^{2x} - 5 \sin 5t + C$

B) $\frac{1}{2}e^{2x} - \frac{1}{5} \sin 5t + C$

C) $\frac{1}{2}e^{2x} + \frac{1}{5} \sin 5t + C$

D) $2e^{2x} + 5 \sin 5t + C$

E) $e^{2x} + \sin 5t + C$

22) Find the Riemann sum using right endpoints that approximates the integral, $\int_0^2 x^2\, dx$, for the given value of $n = 4$. 22) ______

A) 7.85

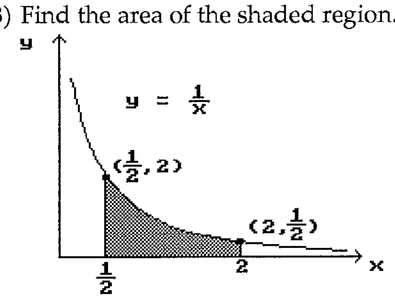
B) 5

C) 7

D) 3.25

E) 3.75

23) Find the area of the shaded region. 23) ______



A) 2 ln2

B) ln2

C) $\frac{9}{4}$

D) $2\frac{1}{2}$

E) −2 ln 2

24) Find the area of the region bounded by the given graphs: $y = 2x - x^2$, $y = 2x - 4$ 24) _______

A) $\frac{54}{3}$

B) $\frac{32}{3}$

C) 12

D) −16

E) $\frac{37}{3}$

25) $\int \frac{\ln x}{x}\,dx = \frac{1}{2}(\ln x)^2 + C$ 25) _______

A) False

B) True

C) No way to verify formula.

D) I don't care; I just want to go home for Christmas.

E) I can't think of any more choices.