

Part I: Multiple Choice Questions (5 Points Each)

- Find the slope of the line joining the points $(1, 1)$ and (e, e^2) .
(a) $e - 1$ (b) $e + 1$ (c) $e^2 - 1$
(d) e (e) There is no line joining those two points.
- Let $f(x) = 3x^2 - 12x + 16$. By completing the square, you can rewrite $f(x)$ in the form $a(x - h)^2 + k$. What is the value of $a + k$?
(a) 5 (b) 19 (c) 7 (d) 11 (e) -9
- Which of the following functions does not have any asymptotes (neither horizontal nor vertical)?
(a) $\frac{x(x^2 - 1)}{x + 1}$ (b) $\frac{x + 3}{x^2 + 1}$ (c) $\frac{x^2 + 1}{x + 3}$
(d) $\frac{x^2 + 1}{3x^2 - 8}$ (e) e^x
- A colony of bacteria is discovered to have a population modelled by the equation $P(t) = \frac{7t^2 + 3t + 14}{2t^2 + 4t + 7}$, where t is measured in days and $P(t)$ is measured in millions. Over a long period of time, at what size population will the colony stabilize?
(a) 3,500,000 (b) 2,000,000 (c) 1,000,000 (d) 7,000,000 (e) 14,000,000
- Let $f(x) = \frac{\sqrt{x}}{x + 1}$. What is the natural domain of $f(x)$?
(a) $(1, \infty)$ (b) $(0, \infty)$ (c) $(-1, \infty)$ (d) $[-1, \infty)$ (e) $[0, \infty)$
- Assume that $f(x)$ is a continuous function on the interval $[-1, 4]$ with the following table of values

x	-1	0	1	2	3	4
$f(x)$	-5	1	2	-3	-1	-3

In which of the following intervals

- I.** $[-1, 0]$ **II.** $[0, 1]$ **III.** $[1, 2]$ **IV.** $[2, 3]$ **V.** $[3, 4]$

can you be sure that the function $f(x)$ has a zero?

- (a) **II** and **IV** (b) **I** and **II** (c) **V** (d) **I** and **III** (e) **II** and **III**

7. A certain bacteria culture grows exponentially. In 2 hours, the population grows from 50,000 to 200,000. Which one of the following choices is a formula expressing the population p as a function of t in hours.

(a) $p(t) = 50,000(\frac{1}{2})^t$ (b) $p(t) = 200,000(2)^t$ (c) $p(t) = 50,000(2)^t$
 (d) $p(t) = 50,000(4)^t$ (e) $p(t) = 50,000t^2$

8. Suppose you make an initial deposit in an account paying 3.5% interest compounded continuously. How much should you deposit to ensure that there will be \$10,000 in 10 years.

(a) $10,000e^{0.35}$ (b) $10,000e^{-0.35}$ (c) $10,000e^{0.035}$
 (d) $10,000(1 + \frac{0.035}{356})^{3560}$ (e) $10,000e^{-0.035}$

9. Assume that Radium-226 is a radioactive substance whose decay equation is

$$y(t) = y_0e^{-0.0004t}$$

with time measured in years. How long does it take a given quantity of Radium to decay to half of its initial amount?

(a) $\frac{1}{0.0004}$ (b) $\frac{\ln 0.5}{0.0004}$ (c) $0.0004 \ln 2$
 (d) $\frac{\ln 2}{0.0004}$ (e) None of the above.

10. Suppose A is a positive number with $\log_5 A = 20$.

Then compute $\log_5 \sqrt{625A^3} = ?$

(a) 0 (b) 12 (c) 24A (d) 16 (e) 32

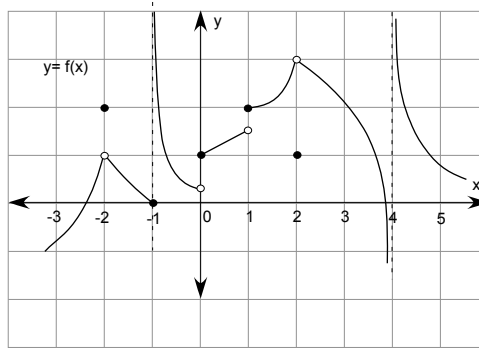
Part II: Partial Credit Questions (10 Points Each)

11. A small company makes chipmunk sweaters. Each sweater costs \$5.00 to produce and sells for \$7.00. The company's fixed costs total \$1,200.

- (a) Find the cost function.
 (b) Find the revenue function.
 (c) Find the break-even point.

12. For the function whose graph is shown in the figure below, find

- (a) all points $x = a$ for which $\lim_{x \rightarrow a} f(x)$ exists but is not equal to $f(a)$;
 (b) all points $x = a$ for which $\lim_{x \rightarrow a^+} f(x) = f(a)$ but is not equal to $\lim_{x \rightarrow a^-} f(x)$.



13. Sketch the graph of a function satisfying the following properties:

(a) It has at least one horizontal asymptote (label it **(a)**).

(b) It has at least one point $x = b$ for which
 $\lim_{x \rightarrow b^-} f(x) = \infty$ and $\lim_{x \rightarrow b^+} f(x) = 5$ (label it **(b)**).

(c) It has at least one point $x = c$ for which $\lim_{x \rightarrow c} f(x)$ exists, but $f(x)$ is not continuous at $x = c$ (label it **(c)**).

14. (a) In 10 years you wish to have \$10,000 in an account paying an annual interest rate of 5% compounded monthly. How much should you deposit into this account now?

(b) You have just deposited \$5,000 in an account paying an annual interest rate of r compounded continuously. What should the value of r be so that your money will triple in 20 years?

15. (a) Determine the constant c so that the function

$$f(x) = \begin{cases} \frac{x^2 + x - 2}{x - 1}, & x \neq 1 \\ c, & x = 1 \end{cases}$$

is continuous.

(b) Solve the following equation for x .

$$\ln(2x - 1) = 3$$