

**Part I—Short Answer Problems:** Give a short answer for each of the following 25 problems on the blank provided. (2 points each)

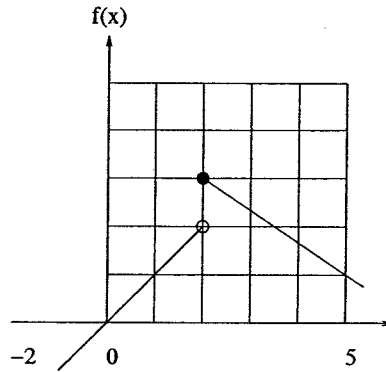


Figure 1: Graph for problems 1–3

For problems 1–3, use the above graph to evaluate the specified quantity.

1.  $\lim_{x \rightarrow 2^-} f(x)$ .

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

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3.  $\lim_{x \rightarrow 2} f(x)$ .

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4. Evaluate  $\lim_{x \rightarrow 2} (2x - x + 2)$ .

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5. Find  $\lim_{t \rightarrow 2} \left( \frac{t+7}{t-3} \right)$ .

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6. Find  $\lim_{x \rightarrow 0} \frac{(x^2 - x)}{x}$ .

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7. For  $f(x) = 4x^3 - 3x^2 + 5$ , find  $f'(-1)$ .

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8. Find  $f'(x)$  given  $f(x) = 3x^5 + 7x^3 + 2x - 1$ .

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9. Find the slope of the curve  $f(x) = \frac{x+3}{x+5}$  at  $x = 0$ .

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10. Find the derivative of  $f(x) = (2x + 5)e^x$ .

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11. Find  $\lim_{x \rightarrow -1} \left( \frac{5x+5}{x^2-1} \right)$ .

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12. For  $y = \ln(3x - 5)$  find  $\frac{dy}{dx}$ .

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13. Find  $\lim_{x \rightarrow 4} \left( \frac{x^2 - 5x + 4}{x^2 - 16} \right)$ .

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14. Given the revenue equation  $R(x) = 1 + 12x - 3x^2$ , find the marginal revenue for  $x = 1.5$ .

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15. Given the profit  $P(x) = -3x^2 + 53x - 10$ , find the marginal profit at  $x = 5$ .

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16. If the fixed cost is \$30 and the unit cost is \$2, find the equation for average cost.

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17. Evaluate  $\int (2x - 5) dx$ .

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18. Evaluate  $\int (x + 3)^2 dx$ .

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19. If the marginal profit is  $\frac{dP}{dx} = 7x - 2 - x^2$ , find the profit.

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20. Evaluate  $\int_1^3 (5x + 7) dx$ .

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21. Evaluate  $\int (x^3 + 1)^2 3x^2 dx$ . \_\_\_\_\_

22. Let  $f(x) = -2x^3 + 3x^2 + 120x$ . Find the interval where  $f(x)$  is increasing. \_\_\_\_\_

23. Let  $f(x) = x^3 - 9x^2 + 15x + 10$ . Find all local minima. \_\_\_\_\_

24. Find all vertical asymptotes of the function  $f(x) = \frac{x^3}{x^2 - 16}$ . \_\_\_\_\_

25. Find the absolute maximum for the function  $f(x) = x^3 - 3x$  on the interval  $[-2, 2]$ . \_\_\_\_\_

**Part II: Application Problems** Please show all work in the space provided. Please draw a CIRCLE or BOX around your final answer to each question.

1. A bank compounded continuously with a 6.84% annual interest rate.
  - (a) If 20,000 dollars is invested in this bank, how much will it be in 8 years?
  - (b) How long will it take for the account to be worth 50,000 dollars?

2. If the marginal profit for producing  $x$  units per day is given by:

$$P'(x) = 1 - 0.02x \quad P(0) = 0$$

where  $P(x)$  is the profit in dollars.

- (a) Find the profit function,  $P(x)$ .
  - (b) What is the profit when 10 units are produced per day.
3. A weekly demand for a certain item is 300 units at a price of \$25 per unit and 400 at \$20. There is a fixed cost of \$5000 and a variable cost of \$5 per unit.
  - (a) Given that the price-demand curve is linear, find the price-demand equation.
  - (b) Find the revenue function.
  - (c) Find the production level that maximizes revenue.
  - (d) What is the profit equation.
  - (e) What production level maximizes profit?
  - (f) What are the break-even points?

4. Given the price-supply function:

$$p = S(x) = 8(e^{0.05x} - 1),$$

where  $x$  is the number of units that can be sold at  $p$  dollars per unit, find the average price (in dollars) over the supply interval  $[40, 50]$ .

5. Find the dimensions of a rectangle with area 1000 square yards with minimum perimeter.