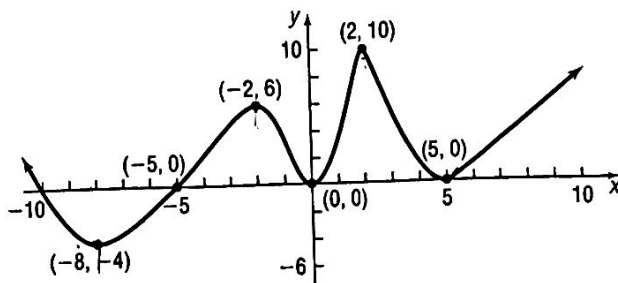


# 2.3 - Properties of Functions

## Skill Building

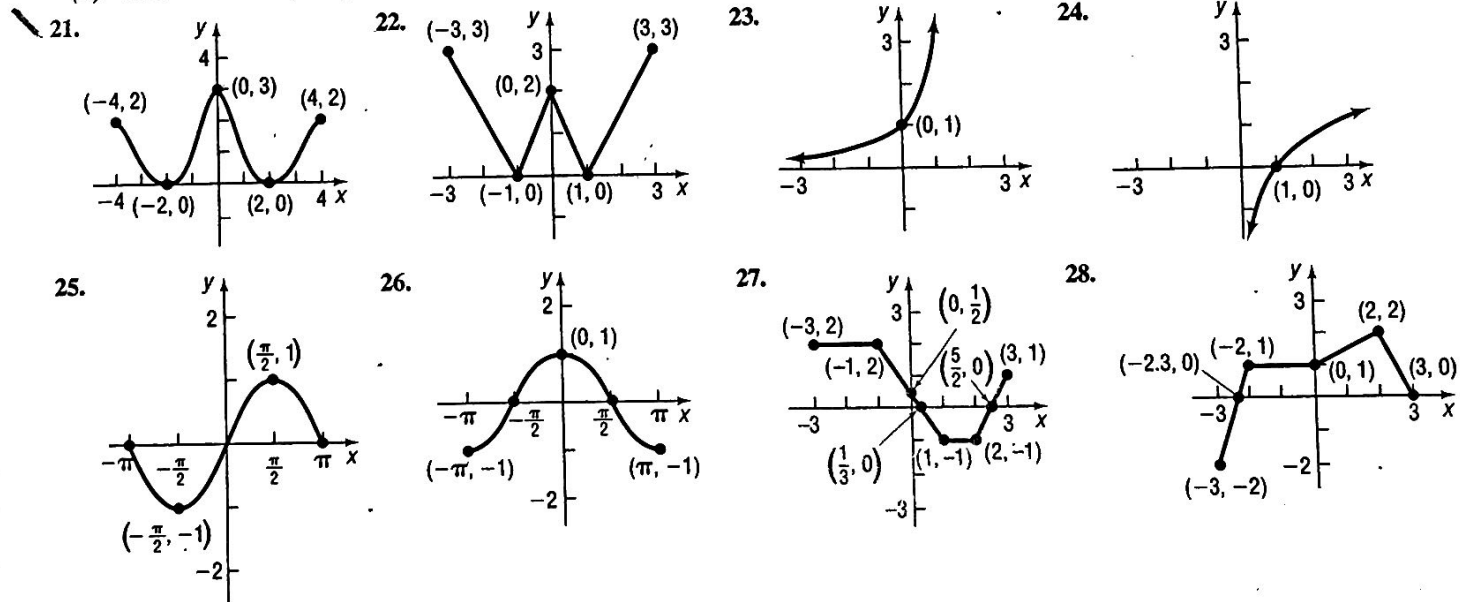
In Problems 11–20, use the given graph of the function  $f$ .



- 11. Is  $f$  increasing on the interval  $(-8, -2)$ ?
- 12. Is  $f$  decreasing on the interval  $(-8, -4)$ ?
- 13. Is  $f$  increasing on the interval  $(2, 10)$ ?
- 14. Is  $f$  decreasing on the interval  $(2, 5)$ ?
- 15. List the interval(s) on which  $f$  is increasing.
- 16. List the interval(s) on which  $f$  is decreasing.
- 17. Is there a local maximum at 2? If yes, what is it?
- 18. Is there a local maximum at 5? If yes, what is it?
- 19. List the numbers at which  $f$  has a local maximum. What are these local maxima?
- 20. List the numbers at which  $f$  has a local minimum. What are these local minima?

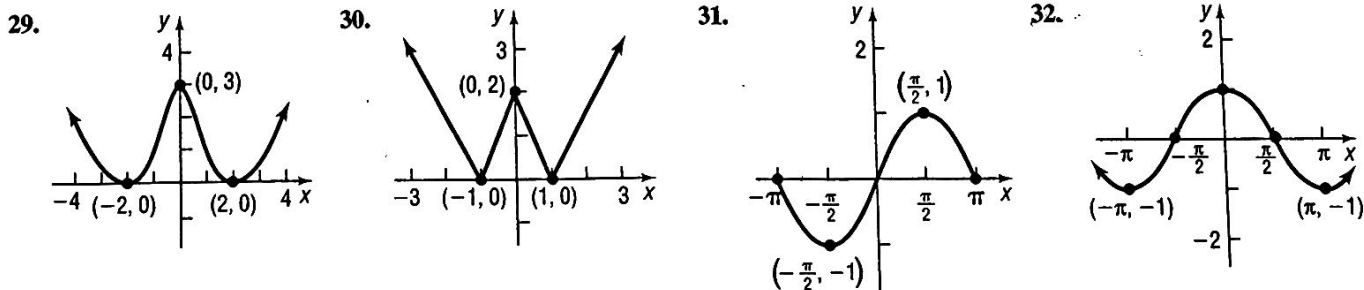
In Problems 21–28, the graph of a function is given. Use the graph to find:

- (a) The intercepts, if any
- (b) The domain and range
- (c) The intervals on which it is increasing, decreasing, or constant
- (d) Whether it is even, odd, or neither



In Problems 29–32, the graph of a function  $f$  is given. Use the graph to find:

- (a) The values, if any, at which  $f$  has a local maximum. What are these local maxima?
- (b) The values, if any, at which  $f$  has a local minimum. What are these local minima?



In Problems 33–44, determine algebraically whether each function is even, odd, or neither.

33.  $F(x) = 4x^3 + x$       34.  $f(x) = 2x^4 - x^2$       35.  $g(x) = -3x^2 - 5$       36.  $h(x) = 3x^5 + 5x$   
 37.  $F(x) = \sqrt[3]{x}$       38.  $G(x) = \sqrt{x}$       39.  $f(x) = x + |x|$       40.  $f(x) = \sqrt[3]{2x^2 + 1}$   
 41.  $g(x) = \frac{1}{x^2}$       42.  $h(x) = \frac{x}{x^2 - 1}$       43.  $h(x) = \frac{-x^3}{3x^2 - 9}$       44.  $F(x) = \frac{2x}{|x|}$

In Problems 45–52, use a graphing utility to graph each function over the indicated interval and approximate any local maxima, local minima. Determine where the function is increasing and where it is decreasing. Round answers to two decimal places.

45.  $f(x) = x^3 - 3x + 2$   $(-2, 2)$       46.  $f(x) = x^3 - 3x^2 + 5$   $(-1, 3)$   
 47.  $f(x) = x^5 - x^3$   $(-2, 2)$       48.  $f(x) = x^4 - x^2$   $(-2, 2)$   
 49.  $f(x) = -0.2x^3 - 0.6x^2 + 4x - 6$   $(-6, 4)$       50.  $f(x) = -0.4x^3 + 0.6x^2 + 3x - 2$   $(-4, 5)$   
 51.  $f(x) = 0.25x^4 + 0.3x^3 - 0.9x^2 + 3$   $(-3, 2)$       52.  $f(x) = -0.4x^4 - 0.5x^3 + 0.8x^2 - 2$   $(-3, 2)$

53. Find the average rate of change of  $f(x) = -2x^2 + 4$

- (a) From 0 to 2  
 (b) From 1 to 3  
 (c) From 1 to 4

54. Find the average rate of change of  $f(x) = -x^3 + 1$

- (a) From 0 to 2  
 (b) From 1 to 3  
 (c) From -1 to 1

55. Find the average rate of change of  $g(x) = x^3 - 2x + 1$

- (a) From -3 to -2  
 (b) From -1 to 1  
 (c) From 1 to 3

56. Find the average rate of change of  $h(x) = x^2 - 2x + 3$

- (a) From -1 to 1  
 (b) From 0 to 2  
 (c) From 2 to 5

57.  $f(x) = 5x - 2$

- (a) Find the average rate of change from 1 to 3.  
 (b) Find an equation of the secant line containing  $(1, f(1))$  and  $(3, f(3))$ .

58.  $f(x) = -4x + 1$

- (a) Find the average rate of change from 2 to 5.  
 (b) Find an equation of the secant line containing  $(2, f(2))$  and  $(5, f(5))$ .

59.  $g(x) = x^2 - 2$

- (a) Find the average rate of change from -2 to 1.  
 (b) Find an equation of the secant line containing  $(-2, g(-2))$  and  $(1, g(1))$ .

60.  $g(x) = x^2 + 1$

- (a) Find the average rate of change from -1 to 2.  
 (b) Find an equation of the secant line containing  $(-1, g(-1))$  and  $(2, g(2))$ .

61.  $h(x) = x^2 - 2x$

- (a) Find the average rate of change from 2 to 4.  
 (b) Find an equation of the secant line containing  $(2, h(2))$  and  $(4, h(4))$ .

62.  $h(x) = -2x^2 + x$

- (a) Find the average rate of change from 0 to 3.  
 (b) Find an equation of the secant line containing  $(0, h(0))$  and  $(3, h(3))$ .