Midterm Exam Review #1

In Exercises 1 and 2, find the derivative of the function by using the definition of the derivative.

1. $f(x) = x^2 - 2x + 3$

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

In Exercises 3–9, find the derivative of the algebraic function.

3. $f(x) = x^3 - 3x^2$

4. $f(x) = \dfrac{2x^3 - 1}{x^2}$

5. $g(t) = \dfrac{2}{3t^3}$

6. $f(x) = \sqrt{1 - x^3}$

7. $f(x) = x^{3/2} - x^{-1/2}$

8. $f(x) = \dfrac{x+1}{x-1}$

9. $h(x) = \dfrac{2}{(3x)^2}$

In Exercises 10–15, find the derivative of the trigonometric function.

10. $y = 3\cos(3x + 1)$

11. $y = \frac{1}{2}\csc 2x$

12. $y = \dfrac{x}{2} - \dfrac{\sin 2x}{4}$

13. $y = 1 - \cos 2x + 2\cos^2 x$

14. $y = \csc 3x + \cot 3x$

15. $y = \dfrac{1 + \sin x}{1 - \sin x}$

In Exercises 16–19, use implicit differentiation to find dy/dx.

16. $x^2 + 3xy + y^3 = 10$

17. $y\sqrt{x} - x\sqrt{y} = 16$

18. $x^2 + 9y^2 - 4x + 3y = 0$

19. $y^2 = (x - y)(x^2 + y)$

In Exercises 20–23, find the equations of the tangent line and the normal line to the graph of the equation at the indicated point.

20. $y = (x + 3)^2, \quad (-2, 1)$

21. $y = (x - 2)^2, \quad (2, 0)$

In Exercises 22 and 23, locate the absolute extrema of the function on the closed interval.

22. $g(x) = 2x + 5\cos x, \quad [0, 2\pi]$

23. $f(x) = \dfrac{x}{\sqrt{x^2 + 1}}, \quad [0, 2]$

In Exercises 24–27, find the critical numbers (if any) and the open intervals on which the function is increasing or decreasing.

24. $f(x) = (x - 1)^2(x - 3)$

25. $g(x) = (x - 1)^3$

26. $h(x) = \sqrt{x}(x - 3)$

27. $f(x) = \sin x - \cos x, \quad 0 \le x \le 2\pi$

In Exercises 28-29 find the point(s) guaranteed by the Mean Value Theorem for the indicated interval.

28. $f(x) = x^{2/3}$
$1 \le x \le 8$

29. $f(x) = \frac{1}{x}$
$1 \le x \le 4$

In Exercises 30 - 33, find any vertical and horizontal asymptotes of the graph of the function.

30. $h(x) = \frac{2x + 3}{x - 4}$

31. $f(x) = \frac{3}{x} - 2$

32. $g(x) = \frac{5x^2}{x^2 + 2}$

33. $f(x) = \frac{3x}{\sqrt{x^2 + 2}}$