Preface

Here are a set of problems for my Calculus I notes. These problems do not have any solutions available on this site. These are intended mostly for instructors who might want a set of problems to assign for turning in. I try to put up both practice problems (with solutions available) and these problems at the same time so that both will be available to anyone who wishes to use them.

As with the set of practice problems I write these as I get the time and some sections will have only a few problems at this point and others won’t have any problems in them yet. Rest assured that I’m always trying to get more problems written but this site has been written and maintained in my spare time and so I usually cannot devote as much time as I’d like to the site.

Differentiation Formulas

For problems 1 – 20 find the derivative of the given function.

1. \( g(x) = 8 - 4x^3 + 2x^8 \)

2. \( f(z) = z^{10} - 7z^5 + 2z^3 - z^2 \)

3. \( y = 8x^4 - 10x^3 - 9x + 4 \)

4. \( f(x) = 3x^{-4} + x^4 - 3x \)

5. \( R(t) = 9t^6 + 8t^{-10} + 12 \)

6. \( h(y) = 3y^{-6} - 8y^{-3} + 9y^{-1} \)

7. \( g(t) = t^{-7} + 2t^{-3} - 6t^2 + 8t^4 - 1 \)

8. \( z = \sqrt[3]{x} - 7\sqrt[4]{x} + 3\sqrt{x} \)

9. \( f(x) = 7\sqrt[2]{x^2} - 2\frac{2}{3}\sqrt{x} + \frac{3}{4}\sqrt{x^4} \)
10. \( h(y) = 6\sqrt{y^3} + \frac{8}{\sqrt[3]{y^2}} + \frac{7}{\sqrt[4]{y^3}} \)

11. \( g(z) = \frac{4}{z^2} + \frac{1}{2z^5} - \frac{1}{2z} \)

12. \( y = \frac{2}{3t^6} + \frac{1}{7t^3} - 9t^2 - \sqrt{t^3} \)

13. \( W(x) = x^3 - \frac{1}{x^6} + \frac{1}{\sqrt{x^2}} \)

14. \( g(w) = (w - 5)(w^2 + 1) \)

15. \( h(x) = \sqrt{x} \left( 1 - 9x^3 \right) \)

16. \( f(t) = (3 - 2t^3)^2 \)

17. \( g(t) = (1 + 2x)(2 - x + x^2) \)

18. \( y = \frac{4 - 8x + 2x^2}{x} \)

19. \( Y(t) = \frac{t^4 - 2t^2 + 7t}{t^3} \)

20. \( S(w) = \frac{w^2(2 - w) + w^3}{3w} \)

For problems 21 – 26 determine where, if anywhere, the function is not changing.

21. \( f(x) = 2x^3 - 9x^2 - 108x + 14 \)

22. \( u(t) = 45 + 300t^2 + 20t^3 - 3t^4 \)

23. \( Q(t) = t^3 - 9t^2 + t - 10 \)
24. \( h(w) = 2w^3 + 3w^2 + 4w + 5 \)

25. \( g(x) = 9 + 8x^2 + 3x^3 - x^4 \)

26. \( G(z) = z^2(z-1)^2 \)

27. Find the tangent line to \( f(x) = 3x^5 - 4x^2 + 9x - 12 \) at \( x = -1 \).

28. Find the tangent line to \( g(x) = \frac{x^2 + 1}{x} \) at \( x = 2 \).

29. Find the tangent line to \( h(x) = 2\sqrt{x} - 8\sqrt{x} \) at \( x = 16 \).

30. The position of an object at any time \( t \) is given by \( s(t) = 3t^4 - 44t^3 + 108t^2 + 20 \).
   
   (a) Determine the velocity of the object at any time \( t \).
   
   (b) Does the object ever stop changing?
   
   (c) When is the object moving to the right and when is the object moving to the left?

31. The position of an object at any time \( t \) is given by \( s(t) = 1 - 150t^3 + 45t^4 - 2t^5 \).
   
   (a) Determine the velocity of the object at any time \( t \).
   
   (b) Does the object ever stop changing?
   
   (c) When is the object moving to the right and when is the object moving to the left?

32. Determine where the function \( f(x) = 4x^3 - 18x^2 - 336x + 27 \) is increasing and decreasing.

33. Determine where the function \( g(w) = w^4 + 2w^3 - 15w^2 - 9 \) is increasing and decreasing.

34. Determine where the function \( V(t) = t^3 - 24t^2 + 192t - 50 \) is increasing and decreasing.

35. Determine the percentage of the interval \([-6, 4]\) on which \( f(x) = 7 + 10x^3 - 5x^4 - 2x^5 \) is increasing.

36. Determine the percentage of the interval \([-5, 2]\) on which \( f(x) = 3x^4 - 8x^3 - 144x^2 \) is decreasing.

37. Is \( h(z) = 3 - x + x^2 + 2x^3 \) increasing or decreasing more on the interval \([-1, 1]\)?
38. Determine where, if anywhere, the tangent line to \( f(x) = 12x^2 - 9x + 3 \) is parallel to the line \( y = 1 - 7x \).

39. Determine where, if anywhere, the tangent line to \( f(x) = 8 + 4x + x^2 - 2x^3 \) is perpendicular to the line \( y = \frac{1}{4}x + \frac{8}{3} \).

40. Determine where, if anywhere, the tangent line to \( f(x) = \sqrt[3]{x} - 8x \) is perpendicular to the line \( y = 2x - 11 \).

41. Determine where, if anywhere, the tangent line to \( f(x) = \frac{13x}{9} + \frac{1}{x} \) is parallel to the line \( y = x \).