1. Consider the function $f(x) = \arcsin x$.
   a) State the domain and range of f. b) Graph f. c) Discuss the domains of f and f'.
2. Consider the function $f(x) = \arccos x$.
   a) State the domain and range of f. b) Graph f.
3. Consider the function $f(x) = \arctan x$.
   a) State the domain and range of f. b) Graph f.
4. Solve each of the following equations over $\mathbb{R}$.
   a) $\sqrt{x^2-4} + \sqrt{4-x^2} = \dfrac{x+2}{5x-1}$ b) $y^2 - 2y + 3 = 1 + \cos x$
5. Differentiate each of the following.
   a) $f(x) = \log_5\left(x^3 - 2x + 6\right)$
   b) $f(x) = \dfrac{x^3 - x + 2}{\ln x}$
   c) $f(x) = \tan 2x$
   d) $f(x) = x\ln x - x$
   e) $f(x) = 5^{3x^2 - x}$
   f) $f(x) = \dfrac{2x-3}{x-1}$
   g) $f(x) = \dfrac{1}{2}xe^{2x} - \dfrac{1}{4}e^{2x}$
   h) $f(x) = \cos^5 x - \cos\left(x^5\right)$
   i) $f(x) = 2^{\sin x}$
   j) $f(x) = \arcsin(\pi x)$
   k) $f(x) = \dfrac{1}{1+x^2}$
6. Find the $x-$coordinate of all relative extrema of each of the following functions.
   a) $f(x) = \dfrac{(x-3)^3}{x^2}$ b) $f(x) = (2-x)^5(2x-3)^8$ c) $f(x) = \dfrac{x^2}{e^{2x}}$ d) $f(x) = \dfrac{x}{1+x^2}$
7. Integrate.
   a) $\displaystyle\int \sin(5x-1)\,dx$
   b) $\displaystyle\int 2^x dx$
   c) $\displaystyle\int \frac{1}{9x^2+1}\,dx$
   d) $\displaystyle\int (3x-8)^{100}\,dx$
   e) $\displaystyle\int \frac{1}{2x-5}\,dx$
   f) $\displaystyle\int \frac{x-3}{x+5}\,dx$
   g) $\displaystyle\int \frac{1}{\sqrt{1-4x^2}}\,dx$
   h) $\displaystyle\int \frac{6x+2}{2x+5}\,dx$
8. The demand for life insurance, L, and the demand for health insurance, H, can be modeled as functions of time, t:

$$\begin{aligned} L(t) &= t^3 + 9t + 100 \text{ for } 0 \le t \le 4 \\ H(t) &= 6t^2 + 102 \text{ for } 0 \le t \le 4 \end{aligned}$$

   During the time period for $0 \le t \le 4$, the greatest difference between the two demands occurs n times. Determine n.
9. Let $f(x) = x^3 + ax^2 + bx - 7$. Find values of a, and b such that f has a relative maximum at $x = 1$ and a relative minimum at $x = 2$.
10. Find an equation of the line tangent to the graph of $f(x) = \dfrac{x^4 - 1}{6x^2 + 1}$ at the point $(1, 0)$.
11. Find $g(x)$, where $g(x)$ is a polynomial of degree 4, and satisfies

$$f(0) = g(0),\ f'(0) = g'(0),\ f''(0) = g''(0),\ f'''(0) = g'''(0),\ \text{and } f^{(4)}(0) = g^{(4)}(0)$$

   where $f(x)$ is given as a) $f(x) = e^x$ b) $f(x) = e^{2x}$

12. We want to construct a box whose base length is 3 times the base width. The material used to build the top and bottom cost \$10 per ft^2 and the material used to build the sides cost \$6 per ft^2. If the box must have a volume of 45 ft^3, determine the dimensions that will minimize the cost to build the box.

13. Consider the unit square $ABCD$. Find the point P on side CD that will make the perimeter of triangle APB the smallest.