1. Determine the derivative of the given functions using the derivative rules. Simplify your answer as much as possible.

   (a) $f(x) = x^2 e^{-3x} + 5^{3x} - 6\ln(x + 3\cos(2x))$

   (b) $y = \arctan(7x) - 3\arcsin(2x)$

   (c) $g(x) = \sinh^3(2x) + 3\cosh(3x)$

   (d) $h(x) = \dfrac{3}{1 + 9e^{-2x}}$

2. Find the antiderivative $F(x)$ of the function $f(x)$ that satisfies $F(1) = 0$ if

$$f(x) = \frac{1}{1+x^2} + 2x + \frac{8}{x}.$$

3. Determine the limit.

(a) $\lim_{x \to 1} \dfrac{1 - x + \ln(x)}{1 + \cos(\pi x)}$

(b) $\lim_{x \to 1} (x + \ln(x))^{\frac{1}{x-1}}$

4. Determine the range of the given function on the interval $1 \leq x \leq 5$.

$$f(x) = x^4 - 4x^3 - 8x^2 + 8$$

5. Find two positive numbers $x$ and $y$ such that the PRODUCT of $x$ and $y$ is 45 and the SUM of 5 times $x$ and 4 times $y$ is a minimum.

6. Graph the function $f(x) = \dfrac{4x^3}{x^2 - 3}$.

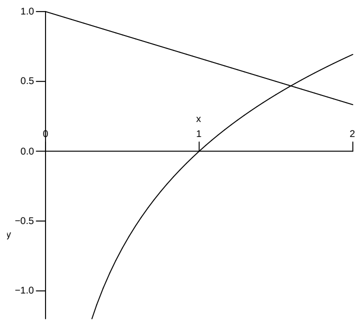
Note: $f'(x) = \dfrac{4x^2(x-3)(x+3)}{(x^2-3)^2}$

(a) Show all vertical and horizontal asymptotes if any exist.

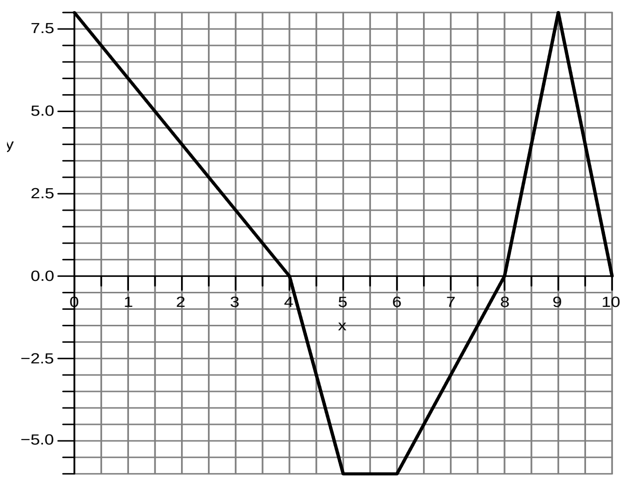
(b) Show axis intercepts if any exist.

(c) Show the exact points of any local minimum values or local maximum values if any exist.

7. Use Newton's Method once to approximate a solution to $\ln(x) = 1 - \frac{1}{2}x$.



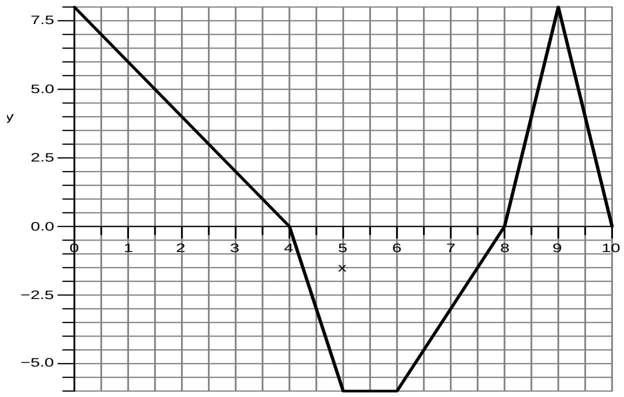

8. Use the velocity plot below to answer the following questions:




$\int_0^4 v(t)dt$____________ $\int_4^5 v(t)dt$____________

$\int_5^8 v(t)dt$____________ $\int_8^{10} v(t)dt$____________

$\int_5^{10} v(t)dt$____________ $\int_0^{10} v(t)dt$____________




9.

Above is the velocity plot from the previous problem. Using the information from the previous problem, sketch $s(t)$, the antiderivative of $v(t)$ given that $s(0) = 0$. Make sure to label $s(4)$, $s(5)$, $s(6)$, $s(8)$, and $s(10)$. Take into consideration the concavity of $s(t)$ and any horizontal tangents.

10. If the velocity is given by $v(x) = 3\sqrt{x} + 4x - 1$, give the displacement of the body on $1 \leq x \leq 4$ which is $\int_1^4 (3\sqrt{x} + 4x - 1)\, dx$.