

1. Determine the given limits

$$(a) \lim_{x \rightarrow 5} \frac{x^2 - 25}{x - 5}$$

$$(b) \lim_{h \rightarrow 0} \frac{37^h - 1}{h}$$

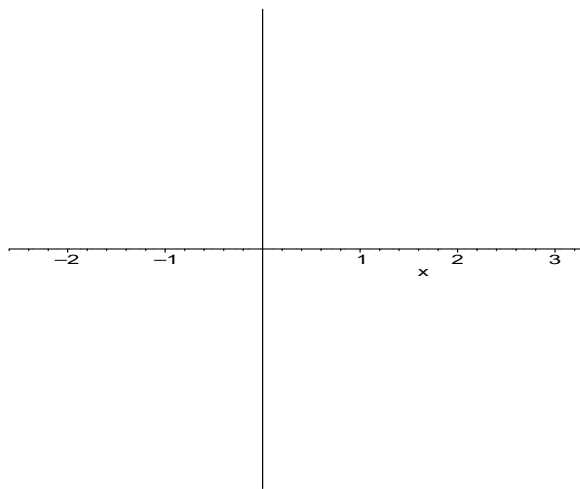
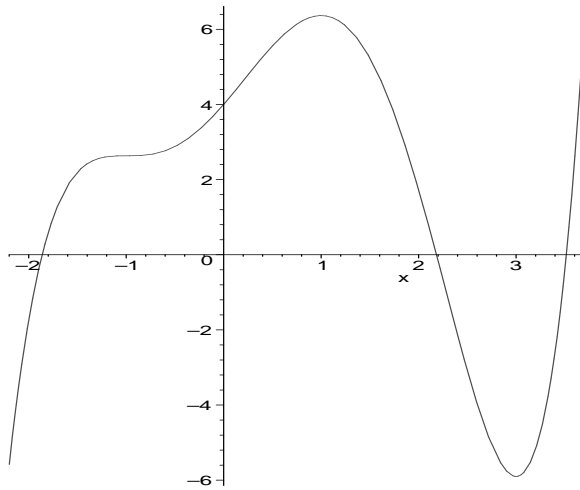
$$(c) \lim_{x \rightarrow 0} \frac{2 \cos 3x - x}{2x}$$

$$(d) \lim_{t \rightarrow \infty} 3t e^{-2t}$$

2. Using the limit definition of the derivative, no shortcuts, show that

$$\frac{d}{dx}(x^2 - 3x + 1) = 2x - 3$$

3. Sketch the graph of the derivative of the given function



4. Differentiate

(a)  $f(x) = \sqrt{1 - 4x^2}$

(b)  $g(x) = e^{-3x} \sin \pi x$

(c)  $k(x) = \arctan(7x^3)$

(d)  $l(x) = \frac{7}{x - 5}$

(e)  $f(x) = x 2^x$

(f)  $g(x) = \ln(1 - x^2)$

(g)  $h(x) = \frac{\tan 2x}{x - \cos 2x}$

(h)  $k(x) = (x^2 - 3x + 1)^7(2x - 3)^4$

(i)  $f(x) = 7 \cos^3(4x - 1)$

5. Given the curve  $3x^2 - 2y^2 + 4xy - x \sin y = 3$

(a) Implicitly differentiate with respect to  $x$  and determine  $\frac{dy}{dx}$  at the point  $(1,0)$ .

(b) Determine the linearization to the curve at  $(1,0)$ .

6. Given the function  $f(x) = x^4 - 4x^3 - 20x^2 + 100$

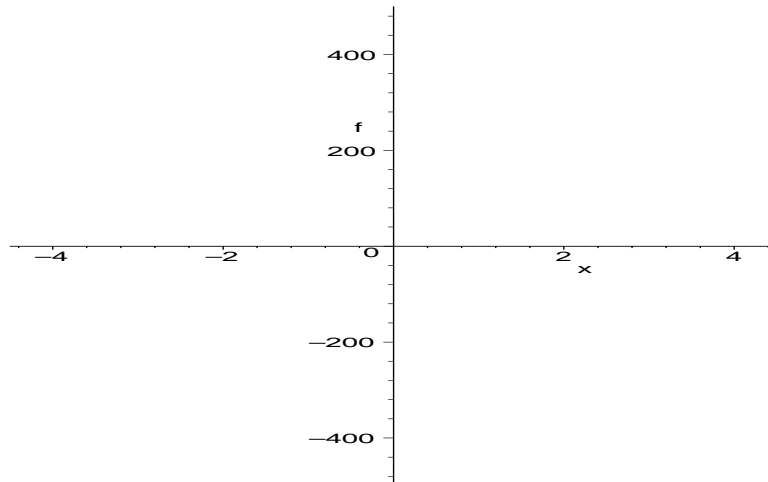
(a) For what value(s) of  $x$  does  $f(x)$  have a local minimum?

(b) What local minimum value(s) does  $f(x)$  have?

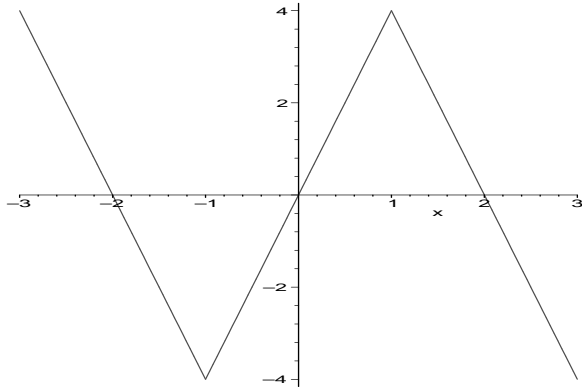
(c) For what value(s) of  $x$  does  $f(x)$  have a local maximum?

(d) What local maximum value(s) does  $f(x)$  have?

(e) Sketch the curve of  $f(x)$ .



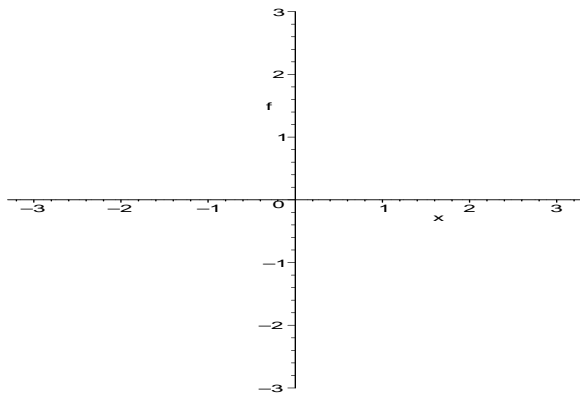
7. Given below is the graph  $f'(x)$ , the derivative of  $f(x)$



(a) If  $f(0) = -1$ , what is  $f(1)$ ?

(b) If  $f(0) = -1$ , what is  $f(-2)$ ?

(c) Sketch the antiderivative of  $f'(x)$  with  $f(0) = -1$ .



8. Determine the Left Riemann Sum for the function  $f(x) = \frac{1}{x}$  on the interval  $[1, 3]$  with  $n = 4$ .

9. Integrate the following

$$(a) \int (x^2 - 3x + 1) dx$$

$$(b) \int \frac{1}{2} \cos 3x dx$$

$$(c) \int 2e^{5x} dx$$

$$(d) \int \frac{6}{1+x^2} dx$$

$$(e) \int \frac{7}{x-1} dx$$

$$(f) \int_2^{10} \frac{1}{\sqrt{x-1}} dx$$

10. Determine by the Fundamental Theorem of Calculus  $\frac{d}{dx} \int_1^{3x^2} u \cos u du$

11. A man stands on the corner of Washington Rd and Chestnut. He begins to walk north on Chestnut St at a rate of 3 ft/sec. At the same time a woman standing 60 feet directly west of Chestnut St at the intersection of Washington Rd and Hazel St begins walking south on Hazel St at a rate of 5 ft/sec. At what rate is the distance between them changing 10 seconds later?

12. Find the point on the line  $y = x - 5$  closest to the point  $(-1, -2)$ .