

*Show all work for credit. Also, give exact answers unless otherwise noted.*

1. Answer the following questions based on the graph of  $f(x)$  shown below:

(a) Find the intervals on which  $f$  is increasing.

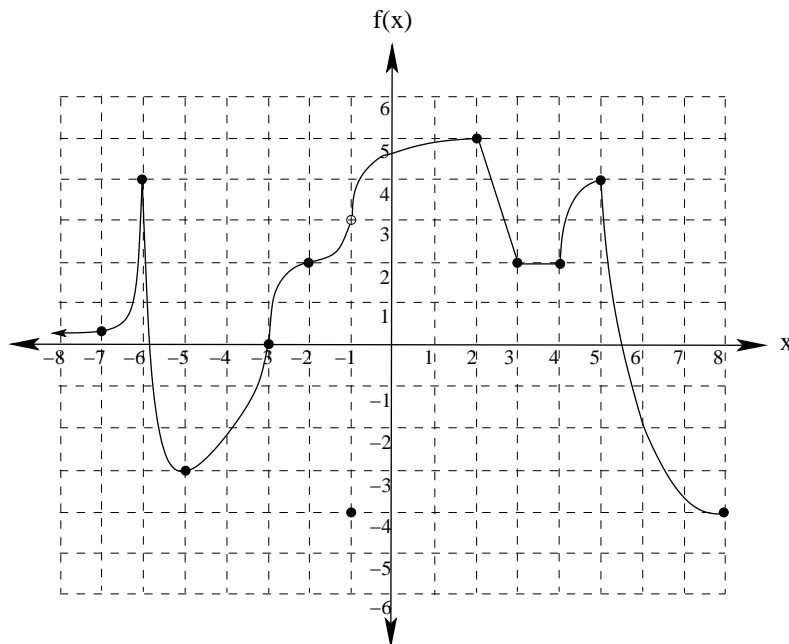
(b) Find the intervals on which  $f$  is decreasing.

(c) Find the  $x$ -values at which a local maximum of  $f$  occurs?

(d) Find the  $x$ -values at which a local minimum of  $f$  occurs?

(e) Find the absolute maximum of  $f$ , if it exists, along with the  $x$ -value(s) where it occurs.

(f) Find the absolute minimum of  $f$ , if it exists, along with the  $x$ -value(s) where it occurs.



2. Find the critical numbers for each of the following functions:

(a)  $f(x) = x^3 - 2x^2 - 4x + 12$

(b)  $f(x) = \frac{x^2 - x + 4}{x - 1}$

(c)  $f(x) = \sin^2 x - \cos x$

(d)  $f(x) = \frac{x^2}{x - 2}$

3. Find the absolute extrema of each function on the given interval:

(a)  $f(x) = x^3 - 7x^2 - 5x + 10$  on  $[-1, 8]$

(b)  $f(x) = 3x^4 - 54x^2 - 7$  on  $[-5, 4]$

(c)  $f(x) = x\sqrt{x+1}$  on  $[-1, 2]$

(d)  $f(x) = \frac{4}{x-3} + 9x + 2$  on  $[0, \frac{7}{2}]$