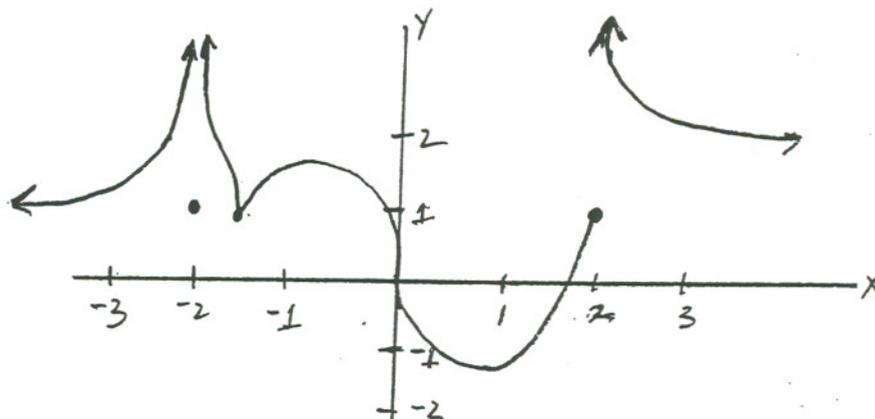


1. The graph of a function f is drawn on the right.



Find the following:

- (a) $\lim_{x \rightarrow -\infty} f(x)$; (b) $\lim_{x \rightarrow -2} f(x)$;
 (c) $\lim_{x \rightarrow 0} f(x)$; (d) $\lim_{x \rightarrow 2^-} f(x)$;
 (e) $\lim_{x \rightarrow 2^+} f(x)$; (f) $\lim_{x \rightarrow 2} f(x)$;
 (g) $\lim_{x \rightarrow \infty} f(x)$. (h) What are the horizontal and vertical asymptotes?
 (i) Where is f discontinuous? (j) Where is f not differentiable?

2. Sketch the graph of an example of a single function which satisfies all of the following conditions:

- (a) $\lim_{x \rightarrow 0^+} f(x) = -2$; (b) $\lim_{x \rightarrow 0^-} f(x) = 1$; (c) $f(0) = -1$; (d) $\lim_{x \rightarrow 2^-} f(x) = \infty$;
 (e) $\lim_{x \rightarrow 2^+} f(x) = -\infty$; (f) $\lim_{x \rightarrow \infty} f(x) = 3$; (g) $\lim_{x \rightarrow -\infty} f(x) = 4$.

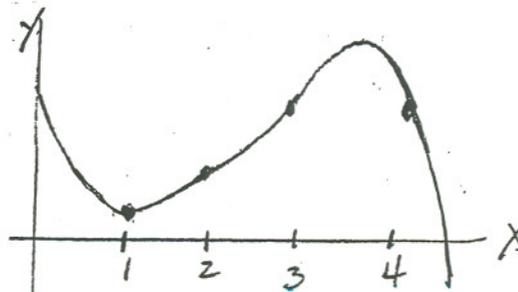
3. Do not use your calculator. Let $f(x) = \frac{x^2}{(x-2)(x+1)}$. Find the following:

- (a) $\lim_{x \rightarrow 2^+} f(x)$; (b) $\lim_{x \rightarrow 2^-} f(x)$; (c) $\lim_{x \rightarrow -1^+} f(x)$; (d) $\lim_{x \rightarrow -1^-} f(x)$; (e) $\lim_{x \rightarrow 0} f(x)$;
 (f) $\lim_{x \rightarrow \infty} f(x)$; (g) $\lim_{x \rightarrow -\infty} f(x)$. (h) Sketch the graph of $y = f(x)$.

4. Use the Intermediate Value Theorem to show that there is a solution to the equation $e^{-x^2} = x$ somewhere in the interval $(0, 1)$.

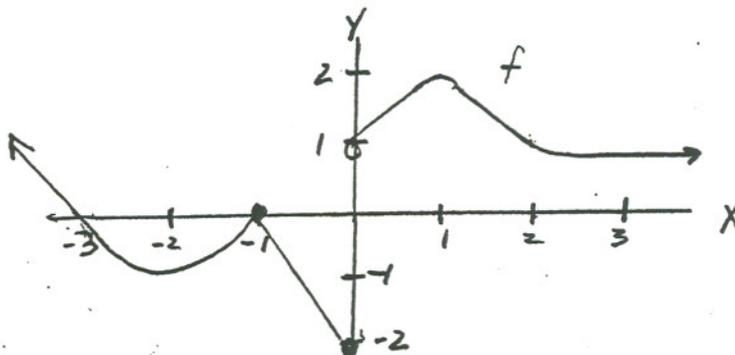
5. For the graph on the right, arrange the following numbers in increasing order:

$f'(1); f'(2); f'(3); \frac{f(4) - f(2)}{2}$



6. If you take a 5 year \$20,000 loan to buy a car, the total cost (C) of the loan is a function of (r), the annual interest rate that you are charged. I.e., $C = f(r)$.
- (a) What does $f(6) = 26,000$ mean? What are the units?
- (b) What does $f'(6) = 1200$ mean? What are the units?
- (c) Use (a) and (b) to approximate $f(6.25)$:
- (d) What is $f(0)$?

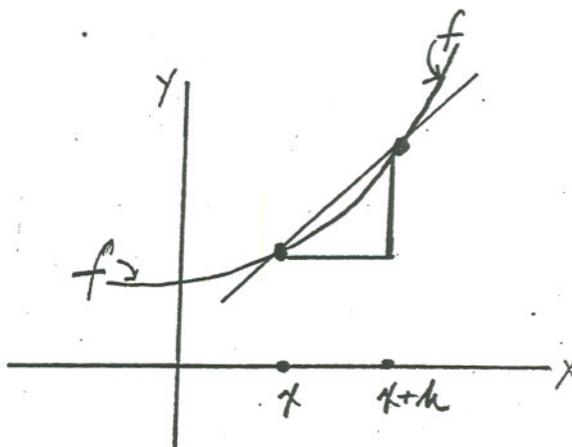
7. The graph of a function f is drawn on the right. Draw the graph of f' .



8. (a) If the tangent line to the curve $y = f(x)$ at the point $(3, 2)$ also goes through the point $(4, 4)$, find $f(3)$ and $f'(3)$.
- (b) Make a careful sketch of the graph for $f(x) = \cos(x)$. Below it sketch a graph for $y = f'(x)$. Guess a formula for $f'(x)$.

9. (a) Label, on the graph to the right, $f(x)$; $f(x+h)$; $f(x+h) - f(x)$; h .

- (b) What is $\frac{f(x+h) - f(x)}{h}$?
- (c) Give the definition for $f'(x)$.
- (d) Use your definition in (c) to find $f'(x)$ if $f(x) = \frac{1}{x} + x$.



10. The table below gives $C(t)$, the total value of U.S. currency in circulation (in billions of dollars) as a function of time t (years).
- (a) Find the average rate of change of the currency over the time interval $[1980, 2000]$.
- (b) Give an estimate for the value of $C'(1990)$.

t	1980	1985	1990	1995	2000
$C(t)$	130	187	272	409	568