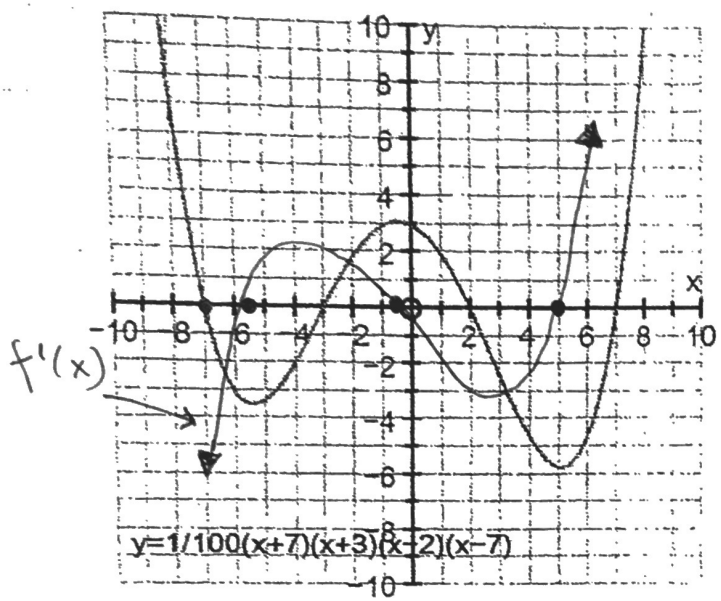
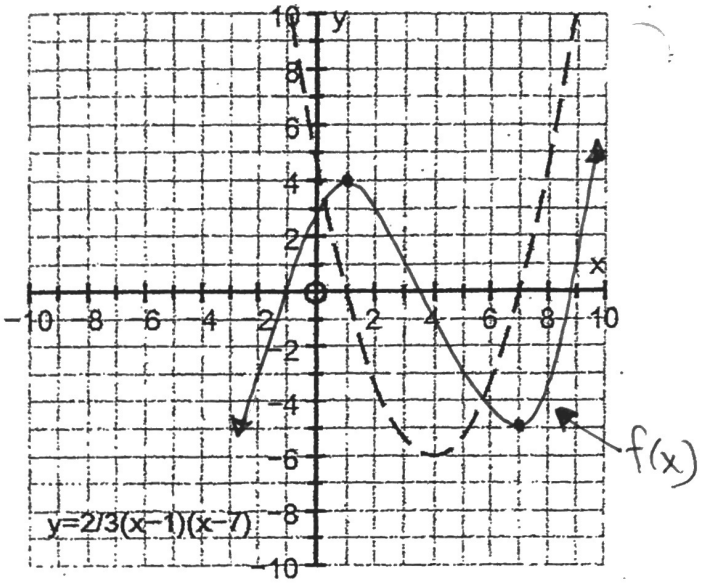
7. Given the graph of $f(x)$, sketch $f'(x)$



8. Given the graph of $f'(x)$, sketch $f(x)$



Challenge Question

1. Find all a and all b for which f is continuous at $x = 0$ *and* $x = 1$. $f(x) = \begin{cases} x^2 - a, & x \le 0 \\ \frac{-2}{x+b}, & 0 < x \le 1 \\ ax - 3, & x > 1 \end{cases}$

$\left[a = -3 \text{ or } 2, b = -\frac{2}{3} \text{ or } 1\right]$

$f(0) = -a$

$\lim_{x \to 0^-} f(x) = -a$

$\lim_{x \to 0^+} f(x) = \frac{-2}{b}$

$\therefore \boxed{-a = \frac{-2}{b}}$ ①

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

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

$\lim_{x \to 1^+} f(x) = a - 3$

$\boxed{a - 3 = \frac{-2}{1+b}}$ ②

sub $a = \frac{2}{b}$ into ②

$\frac{2}{b} - 3 = \frac{-2}{1+b}$

$\frac{2-3b}{b} = \frac{-2}{1+b}$

$(2-3b)(1+b) = -2b$

$2 + 2b - 3b - 3b^2 = -2b$

$3b^2 - b - 2 = 0$

$(3b+2)(b-1) = 0$

$\therefore b = -\frac{2}{3}, 1$ and $a = -3, 2$