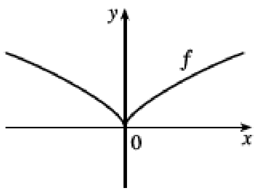
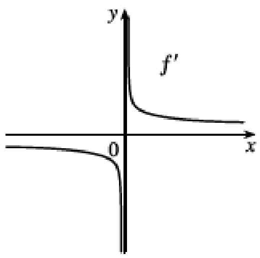
Hints for Exercises 4 – 11: First plot x-intercepts on the graph of f' for any horizontal tangents on the graph of f. Look for any corners on the graph of f — there will be a discontinuity on the graph of f'. On any interval where f has a tangent with positive (or negative) slope, the graph of f' will be positive (or negative). If the graph of the function is linear, the graph of f' will be a horizontal line.

8.





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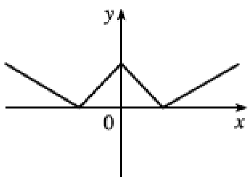

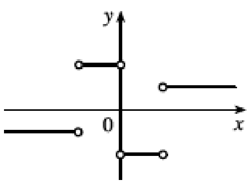

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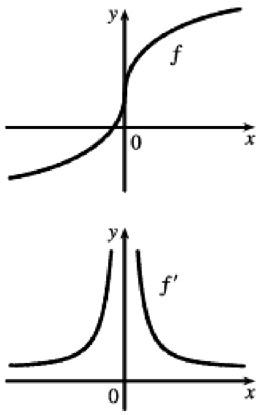
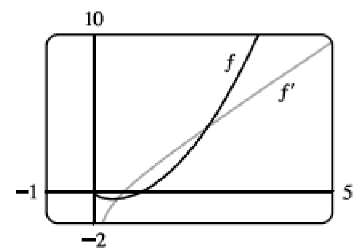


28. (a) $$f'(t) = \lim_{h\to 0} \frac{f(t+h)-f(t)}{h} = \lim_{h\to 0} \frac{\left[(t+h)^2 - \sqrt{t+h}\right] - \left(t^2 - \sqrt{t}\right)}{h}$$
$$= \lim_{h\to 0} \frac{t^2 + 2ht + h^2 - \sqrt{t+h} - t^2 + \sqrt{t}}{h} = \lim_{h\to 0} \left(\frac{2ht+h^2}{h} + \frac{\sqrt{t}-\sqrt{t+h}}{h}\right)$$
$$= \lim_{h\to 0} \left(\frac{h(2t+h)}{h} + \frac{\sqrt{t}-\sqrt{t+h}}{h} \cdot \frac{\sqrt{t}+\sqrt{t+h}}{\sqrt{t}+\sqrt{t+h}}\right)$$
$$= \lim_{h\to 0} \left(2t + h + \frac{t-(t+h)}{h\left(\sqrt{t}+\sqrt{t+h}\,\right)}\right) = \lim_{h\to 0} \left(2t + h + \frac{-h}{h\left(\sqrt{t}+\sqrt{t+h}\,\right)}\right)$$
$$= \lim_{h\to 0} \left(2t + h + \frac{-1}{\sqrt{t}+\sqrt{t+h}}\right) = 2t - \frac{1}{2\sqrt{t}}$$

(b) Notice that $f'(t) = 0$ when f has a horizontal tangent, $f'(t)$ is positive when the tangents have positive slope, and $f'(t)$ is negative when the tangents have negative slope.



32. f is not differentiable at $x = 0$, because there is a discontinuity there, and at $x = 3$, because the graph has a vertical tangent there.

37. $a = f$, $b = f'$, $c = f''$. We can see this because where a has a horizontal tangent, $b = 0$, and where b has a horizontal tangent, $c = 0$. We can immediately see that c can be neither f nor f', since at the points where c has a horizontal tangent, neither a nor b is equal to 0.

39. We can immediately see that a is the graph of the acceleration function, since at the points where a has a horizontal tangent, neither c nor b is equal to 0. Next, we note that $a = 0$ at the point where b has a horizontal tangent, so b must be the graph of the velocity function, and hence, $b' = a$. We conclude that c is the graph of the position function.