THE SECOND DERIVATIVE AND CONCAVITY

1 Find $f''(x)$ for each function.

(a) $f(x) = 3x^2 + 5x + 6$ **(b)** $f(x) = x^3 + 2x^2 + 4x + 2$ **(c)** $f(x) = 24 - x^2$

3 Given $y = \frac{x^2 - 1}{x}$, find $\frac{d^2y}{dx^2}$. Indicate whether each statement below is a correct or incorrect step in finding $\frac{d^2y}{dx^2}$.

(a) $y = x - \frac{1}{x}$ **(b)** $\frac{dy}{dx} = \frac{x^2 - 1}{x^2}$ **(c)** $\frac{dy}{dx} = 1 + \frac{1}{x^2}$ **(d)** $\frac{d^2y}{dx^2} = \frac{-2}{x^2}$

4 Find $\frac{d^2y}{dx^2}$ given: **(a)** $y=\sqrt{x}$ **(b)** $y=\sqrt{x-2}$ **(c)** $y=x\sqrt{x^2+1}$ **(d)** $y=\frac{1}{x}$

4 Find $\frac{d^2y}{dx^2}$ given: **(f)** $y = \frac{x}{x+3}$ **(g)** $y = \frac{x^2+1}{\sqrt{x}}$ **(i)** $y = \frac{\sqrt{x-1}}{x+1}$

5 For what values of x is $y = 5x^2 - 1$ concave up?

6 For what values of x is $y = 6 - 3x^2$ concave down?

10 Explain why the graph of $y = \frac{1}{x^2}$ is concave up over its domain.