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Quiz 8 & 9

Problem 1

Calculate the derivative of the function $f(x) = \sqrt{1-3x}$.

Problem 2

Calculate the derivative of the function $f(x) = \sqrt{2+x}$.

Solution to the Problem 1

$$f'(a) = \lim_{x\to a} \frac{f(x)-f(a)}{x-a} = \lim_{x\to a} \frac{\sqrt{1-3x}-\sqrt{1-3a}}{x-a} = \lim_{x\to a} \frac{\sqrt{1-3x}-\sqrt{1-3a}}{x-a} \frac{\sqrt{1-3x}+\sqrt{1-3a}}{\sqrt{1-3x}+\sqrt{1-3a}}$$
$$= \lim_{x\to a} \frac{(1-3x)-(1-3a)}{(x-a)(\sqrt{1-3x}+\sqrt{1-3a})} = \lim_{x\to a} \frac{-3(x-a)}{(x-a)(\sqrt{1-3x}+\sqrt{1-3a})}$$
$$= \lim_{x\to a} -\frac{3}{\sqrt{1-3x}+\sqrt{1-3a}} = -\frac{3}{\sqrt{1-3a}+\sqrt{1-3a}} = -\frac{3}{2\sqrt{1-3a}}$$

Solution to the Problem 2

$$f'(a) = \lim_{x\to a} \frac{f(x)-f(a)}{x-a} = \lim_{x\to a} \frac{\sqrt{2+x}-\sqrt{2+a}}{x-a} = \lim_{x\to a} \frac{\sqrt{2+x}-\sqrt{2+a}}{x-a} \frac{\sqrt{2+x}+\sqrt{2+a}}{\sqrt{2+x}+\sqrt{2+a}}$$
$$= \lim_{x\to a} \frac{(2+x)-(2+a)}{(x-a)(\sqrt{2+x}+\sqrt{2+a})} = \lim_{x\to a} \frac{(x-a)}{(x-a)(\sqrt{2+x}+\sqrt{2+a})}$$
$$= \lim_{x\to a} \frac{1}{\sqrt{2+x}+\sqrt{2+a}} = \frac{1}{\sqrt{2+a}+\sqrt{2+a}} = \frac{1}{2\sqrt{2+a}}$$