Problem 1. Section 2.3 #88

Use direct substitution to evaluate the limit $\lim_{x\to -2}(4x^2-1)$

$$\lim_{x\to -2}(4x^2-1) = 4(-2)^2-1 = \boxed{15}$$

Problem 2. Section 2.3 #90

Use direct substitution to evaluate the limit $\lim_{x\to 2} e^{2x-x^2}$

$$\lim_{x\to 2} e^{2x-x^2} = e^{2(2)-(2)^2} = e^0 = \boxed{1}$$

Problem 3. Section 2.3 #92

Use direct substitution to evaluate the limit $\lim_{x\to 3} \ln e^{3x}$

$$\lim_{x\to 3} \ln e^{3x} = \ln e^{3(3)} = \ln e^9 = \boxed{9}$$

Problem 4. Section 2.3 #94

Use direct substitution to show that the limit leads to the indeterminate form 0/0. Then, evaluate the limit $\lim_{x\to 2} \frac{x-2}{x^2-2x}$

$$\frac{(2)-2}{(2)^2-2(2)} = \frac{0}{0}$$

$$\lim_{x\to 2} \frac{x-2}{x^2-2x} = \lim_{x\to 2} \frac{x-2}{x(x-2)} = \lim_{x\to 2} \frac{1}{x} = \boxed{\frac{1}{2}}$$

Problem 5. Section 2.3 #96

Use direct substitution to show that the limit leads to the indeterminate form 0/0. Then, evaluate the limit $\lim_{h\to 0} \frac{(1+h)^2-1}{h}$

$$\frac{(1+0)^2-1}{0} = \frac{0}{0}$$

$$\lim_{h\to 0} \frac{(1+h)^2-1}{h} = \lim_{h\to 0} \frac{1^2+2h+h^2-1}{h} = \lim_{h\to 0} \frac{2h+h^2}{h} = \lim_{h\to 0} \frac{h(2+h)}{h} = \lim_{h\to 0} 2+h = \boxed{2}$$

Problem 6. Section 2.3 #102

Use direct substitution to show that the limit leads to the indeterminate form 0/0. Then, evaluate the limit $\lim\limits_{x\to -3} \dfrac{\sqrt{x+4}-1}{x+3}$

$$\frac{\sqrt{(-3)+4}-1}{(-3)+3} = \frac{0}{0}$$

$$\begin{aligned}\lim_{x\to -3} \frac{\sqrt{x+4}-1}{x+3} &= \lim_{x\to -3} \frac{\sqrt{x+4}-1}{x+3}\frac{\sqrt{x+4}+1}{\sqrt{x+4}+1} = \lim_{x\to -3} \frac{(x+4)-1^2}{(x+3)(\sqrt{x+4}+1)}\\ &= \lim_{x\to -3} \frac{x+3}{(x+3)(\sqrt{x+4}+1)} = \lim_{x\to -3} \frac{1}{\sqrt{x+4}+1} = \frac{1}{\sqrt{(-3)+4}} = \boxed{1}\end{aligned}$$

Problem 7. Section 2.3 #104

Use direct substitution to obtain an undefined expression. Then, simplify the function to help determine the limit $\lim\limits_{x\to -2^+} \dfrac{2x^2+7x-4}{x^2+x-2}$

$$\frac{2(-2)^2+7(-2)-4}{(-2)^2+(-2)-2} = \frac{8-14-4}{4-2-2} = \frac{-10}{0}$$

$$\begin{aligned}\lim_{x\to -2^+} \frac{2x^2+7x-4}{x^2+x-2} &= \lim_{x\to -2^+} \frac{2x^2+7x-4}{(x+2)(x-1)} = \lim_{x\to -2^+} \frac{2x^2+7x-4}{x-1}\cdot\frac{1}{x+2}\\ &= \lim_{x\to -2^+} \frac{2x^2+7x-4}{x-1}\cdot \lim_{x\to -2^+} \frac{1}{x+2}\\ &= \frac{2(-2)^2+7(-2)-4}{(-2)-1}\cdot \lim_{x\to -2^+} \frac{1}{x+2} = \frac{-10}{-3}\cdot\infty = \boxed{\infty}\end{aligned}$$

Problem 8. Section 2.3 #108

Assume that $\lim\limits_{x\to 6} f(x) = 4$, $\lim\limits_{x\to 6} g(x) = 9$, *and* $\lim\limits_{x\to 6} h(x) = 6$. *Evaluate the limit* $\lim\limits_{x\to 6} \dfrac{g(x)-1}{f(x)}$

$$\lim_{x\to 6} \frac{g(x)-1}{f(x)} = \frac{\lim\limits_{x\to 6} g(x) - 1}{\lim\limits_{x\to 6} f(x)} = \frac{9-1}{4} = \boxed{2}$$

Problem 9. Section 2.3 #110

Assume that $\lim\limits_{x\to 6} f(x) = 4$, $\lim\limits_{x\to 6} g(x) = 9$, *and* $\lim\limits_{x\to 6} h(x) = 6$. *Evaluate the limit* $\lim\limits_{x\to 6} \dfrac{h(x)^3}{2}$

$$\lim_{x\to 6} \frac{h(x)^3}{2} = \frac{1}{2}\left(\lim_{x\to 6} h(x)\right)^3 = \frac{1}{2}(6)^3 = \boxed{108}$$

Problem 10. Section 2.3 #112

Assume that $\lim_{x\to 6} f(x) = 4$, $\lim_{x\to 6} g(x) = 9$, *and* $\lim_{x\to 6} h(x) = 6$. *Evaluate the limit* $\lim_{x\to 6} x \cdot h(x)$

$$\lim_{x\to 6} x \cdot h(x) = \lim_{x\to 6} x \cdot \lim_{x\to 6} h(x) = 6 \cdot 6 = \boxed{36}$$

Problem 11. Section 2.3 #114

Assume that $\lim_{x\to 6} f(x) = 4$, $\lim_{x\to 6} g(x) = 9$, *and* $\lim_{x\to 6} h(x) = 6$. *Evaluate the limit* $\lim_{x\to 6} f(x) \cdot g(x) - h(x)$

$$\lim_{x\to 6} f(x) \cdot g(x) - h(x) = \lim_{x\to 6} f(x) \cdot \lim_{x\to 6} g(x) - \lim_{x\to 6} h(x) = 4 \cdot 9 - 6 = \boxed{30}$$