2.3B pp.124-127 (39-53 odds, 59-71 odds)

39. $f(t) = t^2 \sin t$

$\boxed{f'(t) = t^2 \cos t + 2t \sin t}$

41. $f(t) = \dfrac{\cos t}{t}$

$\boxed{f'(t) = \dfrac{-t\sin t - \cos t}{t^2}}$

43. $f(x) = -x + \tan x$

$f'(x) = -1 + \sec^2 x$

$\boxed{f'(x) = \tan^2 x}$ identity 6

45. $g(t) = \sqrt[4]{t} + 8\sec t$

$g'(t) = \frac{1}{4}t^{-3/4} + 8\sec t \tan t$

$\boxed{g'(t) = \dfrac{1}{4t^{3/4}} + 8\sec t \tan t}$

47. $y = \dfrac{3(1-\sin x)}{2\cos x}$

$y' = \dfrac{(2\cos x)(-3\cos x) - 3(1-\sin x)(-2\sin x)}{4\cos^2 x}$

$y' = \dfrac{-6\cos^2 x + 6\sin x - 6\sin^2 x}{4\cos^2 x}$

$y' = \dfrac{-6(\sin^2 x + \cos^2 x - \sin x)}{4\cos^2 x}$

There are multiple acceptable answers.

$\boxed{y' = \dfrac{-3(1-\sin x)}{2\cos^2 x}}$ OR

$y' = \dfrac{-3 + 3\sin x}{2\cos^2 x} = \dfrac{-3}{2\cos^2 x} + \dfrac{3\sin x}{2\cos^2 x}$

$\boxed{y' = \dfrac{3}{2}\sec x(\sec x + \tan x)}$

49. $y = -\csc x - \sin x$

$\boxed{y' = \csc x \cot x - \cos x}$

OR

$y' = \dfrac{1}{\sin x} \cdot \dfrac{\cos x}{\sin x} - \cos x$

$y' = \dfrac{\cos x}{\sin^2 x} - \cos x$

$y' = \cos x\left(\dfrac{1}{\sin^2 x} - 1\right) = \cos x(\csc^2 x - 1)$

$\boxed{y' = \cos x \cot^2 x}$

51. $f(x) = x^2 \tan x$

$\boxed{f'(x) = x^2 \sec^2 x + 2x\tan x}$

53. $y = 2x\sin x + x^2 \cos x$

$y' = 2x\cos x + 2\sin x + x^2(-\sin x) + 2x\cos x$

$y' = 2x\cos x + 2\sin x - x^2 \sin x + 2x\cos x$

$\boxed{y' = 4x\cos x + 2\sin x - x^2 \sin x}$

59. $y = \frac{1+\csc x}{1-\csc x}$ $(\pi/6, -3)$

$y' = [(1-\csc x)(-\csc x \cot x) - (1+\csc x)(\csc x \cot x)] / [1-\csc x]^2$

$y' = \frac{-\csc x \cot x + \csc^2 x \cot x - \csc x \cot x - \csc^2 x \cot x}{(1-\csc x)^2}$

$\boxed{y' = \frac{-2\csc x \cot x}{[1-\csc x]^2}}$ $y'(\pi/6) = \frac{-2\csc(\pi/6)\cot(\pi/6)}{[1-\csc(\pi/6)]^2}$

$y'(\pi/6) = \frac{-2(2)(\sqrt{3})}{[1-2]^2}$

$\boxed{y'(\pi/6) = -4\sqrt{3}}$

61. $h(t) = \frac{\sec t}{t}$

$h'(t) = \frac{t \sec t \tan t - \sec t}{t^2}$

$h'(t) = \frac{\sec t\,(t \tan t - 1)}{t^2}$

$h'(\pi) = \frac{\sec \pi\,(\pi \tan \pi - 1)}{\pi^2}$

$h'(\pi) = \frac{(-1)(\pi(0) - 1)}{\pi^2} = \boxed{\frac{-1}{\pi^2}}$

63. $f(x) = (x^3 - 3x + 1)(x+2)$ $(1, -3)$

$f'(x) = (x^3 - 3x + 1) + (x+2)(3x^2 - 3)$

$f'(1) = (1^3 - 3 \cdot 1 + 1) + (1+2)(3 \cdot 1^2 - 3)$

$f'(1) = -1 + 0$

$f'(1) = -1$

$\boxed{y + 3 = -1(x-1)}$

65. $f(x) = \frac{x}{x-1}$ $(2, 2)$ $\boxed{y - 2 = -1(x-2)}$

$f'(x) = \frac{(x-1)(1) - x(1)}{(x-1)^2}$

$f'(x) = \frac{-1}{(x-1)^2}$

$f'(2) = \frac{-1}{(2-1)^2} = -1$

69. $f(x) = \frac{x^2}{x-1}$

$f'(x) = \frac{(x-1)(2x) - x^2}{(x-1)^2} = \frac{2x^2 - 2x - x^2}{(x-1)^2}$

$f'(x) = \frac{x^2 - 2x}{(x-1)^2}$

$f'(x) = 0$ when $x^2 - 2x = 0$

$x(x-2) = 0$

$x = 0 \quad x = 2$

$f(0) = 0 \quad f(2) = 4$

$\boxed{(0,0)\ (2,4)}$

71. $f(x) = \frac{3x}{x+2}$ $g(x) = \frac{5x+4}{x+2}$

$f'(x) = \frac{(x+2)(3) - 3x}{(x+2)^2}$ $g'(x) = \frac{(x+2)(5) - (5x+4)}{(x+2)^2}$

$f'(x) = \frac{3x+6-3x}{(x+2)^2}$ $g'(x) = \frac{5x+10-5x-4}{(x+2)^2}$

$\boxed{f'(x) = \frac{6}{(x+2)^2}}$ $\boxed{g'(x) = \frac{6}{(x+2)^2}}$

f(x) and g(x) have the same slopes at every value of x.

f(x) shifted up 2 is g(x)

$f(x) + 2 = g(x)$

$\frac{3x}{x+2} + 2 = \frac{5x+4}{x+2}$

$\frac{3x}{x+2} + \frac{2(x+2)}{x+2} = \frac{5x+4}{x+2}$

$\frac{5x+4}{x+2} = \frac{5x+4}{x+2}$ ✓