3.8 (2, 4, 6, 12, 14, 20, 28, 32, 44, 50, 64, 66, 68, 70, 74, 94)

(2) $f(x) = \frac{1}{5}x + 7$, $a = -1$

$f(-1) = \frac{-1}{5} + 7 = \frac{34}{5}$

a) $y = f^{-1}(x)$

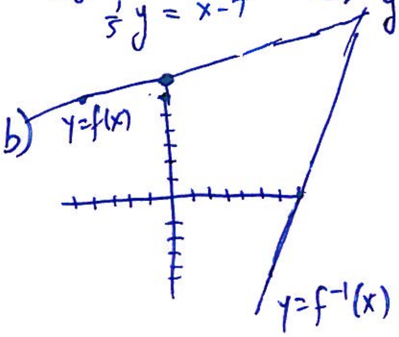
$f(y) = x$

$\frac{1}{5}y + 7 = x$

$\frac{1}{5}y = x - 7 \Rightarrow y = 5x - 35$

$\boxed{f^{-1}(x) = 5x - 35}$

b)



c) $\left.\frac{df}{dx}\right|_{x=-1} = \frac{1}{5}$ $\left.\frac{df^{-1}}{dx}\right|_{x=\frac{34}{5}} = 5$

$5 = \frac{1}{1/5}$ ✓

(4) $f(x) = 2x^2$, $x \geq 0$, $a = 5$

$f(a) = 2 \cdot 5^2 = 50$.

a)

$y = f^{-1}(x)$

$f(y) = x$

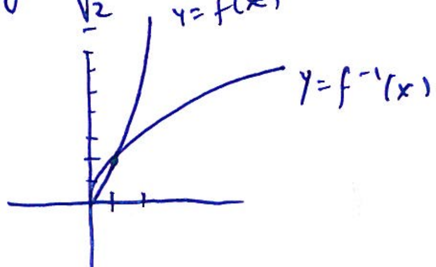
$2y^2 = x$

$y^2 = \frac{x}{2}$

$y = \frac{1}{\sqrt{2}} \cdot \sqrt{x}$

$\boxed{f^{-1}(x) = \frac{1}{\sqrt{2}} \cdot \sqrt{x}}$

b)



c) $f'(x) = 2(2x) = 4x$

$f'(5) = 4(5) = 20$

$$\frac{df^{-1}}{dx} = \frac{1}{\sqrt{2}} \cdot \frac{1}{2} \cdot x^{-1/2}$$

$$\left.\frac{df^{-1}}{dx}\right|_{x=50} = \frac{1}{\sqrt{2}} \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{50}} = \frac{1}{2} \cdot \frac{1}{\sqrt{100}} = \frac{1}{20}$$

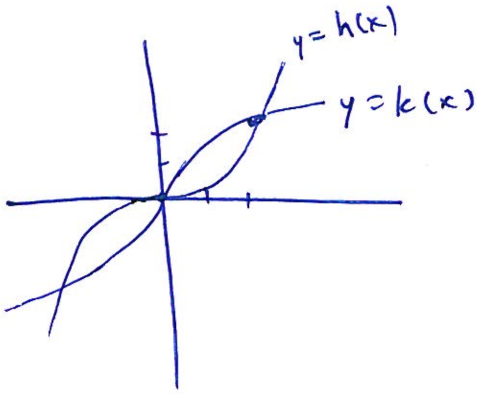
$$\frac{1}{20} = \frac{1}{20} \quad \checkmark.$$

6 a) $h(x) = \frac{x^3}{4}$ $\quad k(x) = (4x)^{1/3}$

$$h(k(x)) = \frac{((4x)^{1/3})^3}{4} = \frac{4x}{4} = x$$

$$k(h(x)) = \left(4 \cdot \frac{x^3}{4}\right)^{1/3} = (x^3)^{1/3} = x.$$

b)



c) $h'(x) = \frac{3x^2}{4}$ $\quad h'(2) = \frac{3(2^2)}{4} = \boxed{3}$ $\quad h'(-2) = \boxed{3}$

$k'(x) = \frac{1}{3}(4x)^{-2/3} \cdot 4$ $\quad k'(2) = \frac{1}{3} \cdot 8^{-2/3} \cdot 4$ $\quad k'(-2) = \frac{1}{3} \cdot (-8)^{-2/3} \cdot 4$

$=$ $\quad = \frac{4}{3} \cdot \frac{1}{4} = \boxed{1/3}$ $\quad = \frac{4}{3} \cdot \frac{1}{4} = \boxed{1/3}$

12 $y = \ln(kx) = \ln(k) + \ln x$

$$\boxed{\frac{dy}{dx} = \frac{1}{x}}$$

14 $y = \ln(t^{3/2}) = \frac{3}{2}\ln(t)$

$$\boxed{\frac{dy}{dt} = \frac{3}{2} \cdot \frac{1}{t}}$$

20 $y = (\ln x)^3$

$$\boxed{\frac{dy}{dx} = 3(\ln x)^2 \cdot \frac{1}{x}}$$

28 $y = \dfrac{x\ln x}{1+\ln x}$

$$\frac{dy}{dx} = \frac{(1+\ln x)(\ln x + x\cdot\frac{1}{\cancel{x}}) - \cancel{x}\ln x\,(\frac{1}{\cancel{x}})}{(1+\ln x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{(1+\ln x)^2 - \ln x}{(1+\ln x)^2}}$$

32 $y = \ln(\sec\theta + \tan\theta)$

$$\boxed{\frac{dy}{d\theta} = \frac{1}{\sec\theta + \tan\theta} \cdot [\sec\theta\tan\theta + \sec^2\theta]}$$

34 $y = \sqrt{\frac{1}{t(t+1)}}$

$\ln y = \frac{1}{2}(\ln(\frac{1}{t(t+1)})) = \frac{1}{2}[-\ln(t) - \ln(t+1)]$

$\frac{1}{y}\frac{dy}{dt} = \frac{1}{2}[-\frac{1}{t} - \frac{1}{t+1}]$

$$\boxed{\frac{dy}{dt} = \frac{1}{2}\sqrt{\frac{1}{t(t+1)}}\,[-\frac{1}{t} - \frac{1}{t+1}]}$$

58

$$y = \frac{\theta \sin\theta}{\sqrt{\sec\theta}}$$

$$\ln y = \ln\theta + \ln(\sin\theta) - \frac{1}{2}\ln\sec\theta$$

$$\ln y = \ln\theta + \ln(\sin\theta) + \frac{1}{2}\ln(\cos\theta)$$

$$\frac{1}{y}\frac{dy}{d\theta} = \frac{1}{\theta} + \frac{1}{\sin\theta}\cdot\cos\theta + \frac{1}{2}\frac{1}{\cos\theta}\cdot(-\sin\theta)$$

$$\boxed{\frac{dy}{d\theta} = \frac{\theta\sin\theta}{\sqrt{\sec\theta}}\left[\frac{1}{\theta} + \cot\theta - \frac{1}{2}\tan\theta\right]}$$

64

$$\ln(xy) = e^{x+y}$$

$$\frac{1}{xy}\cdot\left[y + x\frac{dy}{dx}\right] = e^{x+y}\left(1 + \frac{dy}{dx}\right)$$

$$\frac{1}{x} + \frac{1}{y}\frac{dy}{dx} = e^{x+y} + e^{x+y}\frac{dy}{dx}$$

$$\left(\frac{1}{y} - e^{x+y}\right)\frac{dy}{dx} = e^{x+y} - \frac{1}{x}$$

$$\boxed{\frac{dy}{dx} = \frac{e^{x+y} - \frac{1}{x}}{\frac{1}{y} - e^{x+y}}}$$

66

$$\tan y = e^x + \ln x$$

$$\sec^2 y\,\frac{dy}{dx} = e^x + \frac{1}{x}$$

$$\frac{dy}{dx} = \frac{e^x + \frac{1}{x}}{\sec^2(y)}$$

$$\boxed{\frac{dy}{dx} = \left(e^x + \frac{1}{x}\right)\cos^2(y)}$$

68 $y = 3^{-x}$

$$\boxed{\frac{dy}{dx} = \ln(3)\ 3^{-x} \cdot (-1)}$$

70 $y = 2^{s^2}$

$$\boxed{\frac{dy}{ds} = \ln(2)\ 2^{s^2} \cdot 2s}$$

74 $y = \log_3(1 + \theta \ln(3))$

$$\frac{dy}{d\theta} = \frac{1}{\cancel{\ln(3)}} \cdot \frac{1}{(1+\ln(3)\cdot\theta)} \cdot \cancel{\ln(3)}$$

$$\boxed{\frac{dy}{d\theta} = \frac{1}{1+\ln(3)\cdot\theta}}$$

94 $y = x^{\sin x}$

$\ln y = \ln(x^{\sin x}) = \sin x \ln(x)$

$\frac{1}{y}\frac{dy}{dx} = \cos x \cdot \ln x + \frac{\sin x}{x}$

$$\boxed{\frac{dy}{dx} = x^{\sin x}\left[\cos x \cdot \ln x + \frac{\sin x}{x}\right]}$$