1

a)$\cos x$
b)$\sec^2 x$
c)e^x
d)$\frac{1}{x}$
e)$5x^4$

2

a)$2x + 4$
b)$\cos(x) - \sin(x)$
c)$e^x + 12x^2$

3

a)$e^x(\sin(x) + \cos(x))$
b)$2(\cos^2 x - \sin^2 x)$
c)$x\cos(x) + \sin(x)$

4

a)$\sec^2(x)$
b)$\frac{1}{3}\frac{(2x+e^x)\cos(x)+(x^2+e^x)\sin(x)}{\cos^2 x}$

5

a)

$$\begin{aligned} \frac{d}{dx}[\sin(2x)] &= \frac{d[\sin(2x)]}{d(2x)} \times \frac{d(2x)}{dx} \\ &= 2\cos(2x) \end{aligned}$$

b)

$$\begin{aligned} \frac{d}{dx}[e^{x^2}] &= \frac{d[e^{x^2}]}{d(x^2)} \times \frac{d(x^2)}{dx} \\ &= 2xe^{x^2} \end{aligned}$$

c)

$$\begin{aligned}
\frac{d}{dx}(3x+4)^{25} &= \frac{d[(3x+4)^{25}]}{d(3x+4)} \times \frac{d(3x+4)}{dx} \\
&= 3.25(3x+4)^{24} \\
&= 75(3x+4)^{24}
\end{aligned}$$

6

a)

$$\begin{aligned}
\frac{d}{dx}[\log(x+2+\sqrt{x^2+4x+1})] &= \frac{d[\log(x+2+\sqrt{x^2+4x+1})]}{d(x+2+\sqrt{x^2+4x+1})} \times \frac{d(x+2+\sqrt{x^2+4x+1})}{dx} \\
&= \frac{1}{(x+2+\sqrt{x^2+4x+1})} \times \left(1+\frac{d(\sqrt{x^2+4x+1})}{dx}\right) \\
&= \frac{1}{(x+2+\sqrt{x^2+4x+1})} \times \left(1+\frac{d(\sqrt{x^2+4x+1})}{d(x^2+4x+1)} \times \frac{d(x^2+4x+1)}{dx}\right) \\
&= \frac{1}{(x+2+\sqrt{x^2+4x+1})} \times \left(1+\frac{1}{2\sqrt{x^2+4x+1}} \times (2x+4)\right) \\
&= \frac{1}{(x+2+\sqrt{x^2+4x+1})} \times \left(1+\frac{(x+2)}{\sqrt{x^2+4x+1}}\right)
\end{aligned}$$

b)

$$\begin{aligned}
\frac{d}{dx}[\sin(x^2\sin(x))] &= \frac{d[\sin(x^2\sin(x))]}{d(x^2\sin(x))} \times \frac{d(x^2\sin(x))}{dx} \\
&= \cos(x^2\sin(x)) \times (x^2\cos(x)+2x\sin(x)) \\
\frac{d}{dx}[\sqrt{1+(2x+3)^2}] &= \frac{d[\sqrt{1+(2x+3)^2}]}{d[1+(2x+3)^2]} \times \frac{d[1+(2x+3)^2]}{dx} \\
&= \frac{1}{2\sqrt{1+(2x+3)^2}} \times \left(0+\frac{d(2x+3)^2}{d(2x+3)} \times \frac{d(2x+3)}{dx}\right) \\
&= \frac{1}{2\sqrt{1+(2x+3)^2}} \times (8(2x+3)) \\
&= \frac{4(2x+3)}{\sqrt{1+(2x+3)^2}} \\
\frac{d}{dx}\left[\frac{\sin(x^2\sin(x))}{\sqrt{1+(2x+3)^2}}\right] &= \frac{\sqrt{1+(2x+3)^2}\,\frac{d(\sin(x^2\sin(x)))}{dx} - \sin(x^2\sin(x))\,\frac{d\sqrt{1+(2x+3)^2}}{dx}}{1+(2x+3)^2}
\end{aligned}$$

Just put the values now. Or you may choose not to. What is important is that get the idea right.

7

$$\begin{aligned}
x^2 + 2xy + y^3 &= 42 \\
\text{Differentiate both sides wrt x} & \\
\frac{dx^2}{dx} + 2\frac{d(xy)}{dx} + \frac{dy^3}{dx} &= 0 \\
2x + 2\left(x\frac{dy}{dx} + y\right) + \frac{dy^3}{dy} \times \frac{dy}{dx} &= 0 \\
2x + 2x\frac{dy}{dx} + 2y + 3y^2\frac{dy}{dx} &= 0 \\
\frac{dy}{dx} &= -\frac{2(x+y)}{(2x+3y^2)}
\end{aligned}$$

8

$$\begin{aligned}
x &= \sin(y) \\
\text{Differentiate wrt x} & \\
1 &= \frac{d\sin(y)}{dy}\frac{dy}{dx} \\
1 &= \cos(y)\frac{dy}{dx} \\
\frac{dy}{dx} &= \frac{1}{\cos(y)} \\
&= \frac{1}{\sqrt{1-\sin^2(y)}} \\
&= \frac{1}{\sqrt{1-x^2}}
\end{aligned}$$

Now you know how the derivative of inverse trigonometric functions is found.

9

a)

$$\begin{aligned}
\frac{d}{dx}[\tan^{-1}(m\sin(x))] &= \frac{d(\tan^{-1}(m\sin(x)))}{d(m\sin(x))} \times \frac{d(m\sin(x))}{dx} \\
&= \frac{m\cos(x)}{1+m^2\sin^2(x)}
\end{aligned}$$

b)

$$\frac{d}{dx}\left[\sin^{-1}\left(\frac{2x}{1+x^2}\right)\right] = \frac{d\left[\sin^{-1}\left(\frac{2x}{1+x^2}\right)\right]}{d\left(\frac{2x}{1+x^2}\right)} \times \frac{d\left(\frac{2x}{1+x^2}\right)}{dx} \tag{1}$$

Use the derivative of sine inverse for the first derivative and quotient rule for the second derivative.