Name_____

1. Compute the derivative of each function.

   (a) $f(x) = \cos(\sqrt{x})$

   Solution

   $$\frac{d}{dx}(\cos(\sqrt{x})) = -\sin(\sqrt{x})\frac{d}{dx}(\sqrt{x}) = -\frac{\sin(\sqrt{x})}{2\sqrt{x}}$$

   (b) $f(x) = \dfrac{2x+1}{3x-4}$

   Solution

   $$\frac{d}{dx}\left(\frac{2x+1}{3x-4}\right) = \frac{(2x+1)'(3x-4) - (2x+1)(3x-4)'}{(3x-4)^2} = \frac{2(3x-4) - 3(2x+1)}{(3x-4)^2} = \frac{-11}{(3x-4)^2}$$

2. Compute each integral below.

   (a) $\displaystyle\int x\sqrt{x^2+1}\, dx$

   Solution (u-substitution)
   Let $u = x^2 + 1$. Then $du = 2x\, dx$, so

   $$dx = \frac{du}{2x}$$

   Then

   $$\int x\sqrt{x^2+1}\, dx = \frac{1}{2}\int \sqrt{u}\, du = \frac{1}{3}u^{\frac{3}{2}} = \frac{1}{3}(x^2+1)^{\frac{3}{2}} + c$$

   (b) $\displaystyle\int xe^x\, dx$

   Solution (integration by parts)
   Let

   $$u = x \qquad dv = e^x\, dx$$
   $$du = dx \qquad v = e^x$$

   So

   $$\int xe^x\, dx = uv - \int v\, du = xe^x - \int e^x\, dx = xe^x - e^x + c$$