Practice with exponential functions with bases other than e:

1. Find the derivatives:

a. $f(x) = 8^x$

b. $g(x) = 17^x$

2. Find the integrals:

a. $\int 2^x\,dx$

b. $\int_{-1}^{1} 4^x dx$

c. $\int_{-1}^{2} 5^x dx$

Answers on next page.

1. Find the derivatives:

a. $f(x) = 8^x = e^{ln(8)\cdot x}$

$f'(x) = e^{ln(8)\cdot x} \cdot \ln(8) = 8^x \cdot \ln(8)$

b. $g(x) = 17^x = e^{\ln(17)\cdot x}$

$g'(x) = e^{\ln(17)\cdot x} \cdot \ln(17) = 17^x \cdot \ln(17)$

2. Find the integrals:

a. $\int 2^x dx = \int e^{\ln(2)\cdot x} dx$

$= \int e^u \cdot \frac{1}{\ln(2)} du$

$= e^u \cdot \frac{1}{\ln(2)} + C = \frac{1}{\ln(2)} e^{\ln(2)\cdot x} + C$

$= \frac{2^x}{\ln(2)} + C$

$u = \ln(2) \cdot x$

$\frac{du}{dx} = \ln(2)$

$du = \ln(2) \cdot dx$

$\frac{1}{\ln(2)} du = dx$

b. $\int_{-1}^{1} 4^x dx = \int_{-1}^{1} e^{\ln(4)\cdot x} dx$

$\int e^u \cdot \frac{1}{\ln(4)} du = \frac{e^u}{\ln(4)} + C$

$= \frac{e^{\ln(4)\cdot x}}{\ln(4)} + C = \frac{4^x}{\ln(4)} + C$

$\int_{-1}^{1} 4^x dx = \left. \frac{4^x}{\ln(4)} \right|_{-1}^{1} = \frac{4}{\ln(4)} - \frac{4^{-1}}{\ln 4} \approx 2.885 - .180 = 2.705$

$u = \ln(4) \cdot x$

$\frac{du}{dx} = \ln(4)$

$du = \ln(4) dx$

$\frac{1}{\ln(4)} du = dx$

c. $\int_{-1}^{2} 5^x dx = \int_{-1}^{5} e^{\ln(5)\cdot x} dx$

$\int e^u \frac{1}{\ln(5)} du = \frac{e^u}{\ln(5)} + C$

$= \frac{e^{\ln(5)\cdot x}}{\ln(5)} + C = \frac{5^x}{\ln(5)} + C$

$\int_{-1}^{2} 5^x dx = \left. \frac{5^x}{\ln(5)} \right|_{-1}^{2} = \frac{5^2}{\ln(5)} - \frac{5^{-1}}{\ln(5)} = \frac{25}{\ln(5)} - \frac{.2}{\ln(5)} \approx 39.914$

$u = \ln(5) \cdot x$

$\frac{du}{dx} = \ln(5)$

$du = \ln(5) dx$

$\frac{1}{\ln(5)} du = dx$