1. Evaluate the following integral. Check by differentiating.

$$\int (x+1)^2 \ln(3x)\ dx$$

$$\int_1^2 x^2 \cos x\ dx$$

$$\int_0^1 x^2 e^x\ dx$$

$$\int_1^2 x^3 \ln x\ dx$$

$$\int_0^5 t\sqrt{t+15}\ dt$$

$$\int te^{-kt}\ dt \qquad \text{(for some constant k.)}$$

$$\int \frac{e^x\ dx}{4+e^x}$$

$$\int \sin^2 x \cos x\ dx$$

$$\int \cos^2 x \sin x\ dx$$

$$\int \frac{\sin t\ dt}{e^{\cos t}}$$

$$\int_0^\pi e^{-\sin t} \cos t\ dt$$

$$\int_0^3 (x-5)^2\ dx$$

2. Determine whether the following integrals converge or diverge.

$$\int_0^1 \frac{r\ dr}{\sqrt{1-r^2}}$$

$$\int_0^\infty \frac{dx}{\sqrt{x}}$$

$$\int_1^\infty 2xe^{-x^2}\ dx$$

$$\int_0^1 \frac{2}{x}\ dx$$