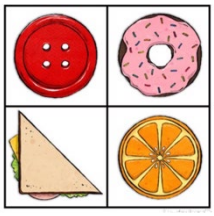
Which One Doesn't Belong?



We've seen that some integrals are easy to solve because they simply reverse the differentiation process. But there are many others that do not follow our basic rules. In fact, there are integrals that cannot be solved without technology and others that can't be solved at all. Let's explore why.

1. In the set of integrals shown below, there is one integral that can't be solved (by hand). Find each antiderivative and determine which one can't be solved. Explain why it can't be solved.

$$\int \cos x \, dx =$$

$$\int \cos(x^2) dx =$$

$$\int 2x \cos(x^2) dx =$$

2. In the set of integrals shown below, there is one integral that can't be solved (by hand). Find each antiderivative and determine which one can't be solved. Explain why it can't be solved.

$$\int \frac{1}{x} dx =$$

$$\int \frac{1}{(x-3)} dx =$$

$$\int \frac{1}{(2x-3)} dx =$$

$$\int \frac{1}{(x^2-3)} dx =$$

$$\int \frac{3x^2}{(x^3-3)} dx =$$

3. Let's look at a slightly more complex integral and see if we can apply the patterns we found above. We'll use $\int xcos(x^2 - 2)\, dx$.
   a) Identify the inside function.

   b) What's the derivative of the inside function?

   c) Do you see this derivative somewhere in the integrand? Why is this important?

   d) How could you re-write the integrand so that we see this derivative *exactly*?

4. Find the antiderivative.

Section 5.5 —Integrating using Substitution

Important Ideas:

Check Your Understanding!

For questions 1-6, integrate.

1. $\int (3x-4)^5 dx$

2. $\int \sec(7x)\tan(7x)\, dx$

3. $\int (4x^3-2)e^{x^4-2x} dx$

4. $\int x^2\sqrt{x^3+1} dx$

5. $\int 3x \sin(3x^2)\, dx$

6. $\int \tan x\, dx$ (Hint: re-write the integrand in terms of sine and cosine).