INTEGRATION REVIEW I

Example. Evaluate $\int x^3\,dx$.

Solution. We must find the general form for antiderivative of the function $f(x) = x^3$. This means finding a function $F(x)$ such that $F'(x) = x^3$.

We know from the power rule for derivatives that $\frac{d}{dx}[x^4] = 4x^3$. It follows that $\frac{d}{dx}\left[\frac{1}{4}x^4\right] = x^3$.

Therefore $\int x^3\,dx = \frac{1}{4}x^4 + C$.

1. Evaluate the following indefinite integrals. (Remember you can always check your answers by differentiating).

a) $\displaystyle\int x^5\,dx$

b) $\displaystyle\int \frac{1}{x^3}\,dx$

c) $\displaystyle\int \sqrt{x}\,dx$

d) $\displaystyle\int x^{-1}\,dx$

2. Fill in the blank to finish the statement: If a is a real number, then $\int x^a\,dx = \begin{cases} & \text{if} \\ & \text{if} \end{cases}$

One theme of chapter 6 is that differentiation rules (usually) have corresponding integration rules. You just stated an integration version of the power rule. You should also know an integration version of another important differentiation rule.

3. What differentiation rule do you use in evaluating the following derivatives? (No need to evaluate these derivatives, though it may find it helpful to do so when you're working on problem 4).

a) $\frac{d}{dx}[(x^2+1)^5]$
b) $\frac{d}{dx}[\ln(2x+1)]$
c) $\frac{d}{dx}[\cos(x^3)]$

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4. What integration rule do you use in evaluating the following indefinite integrals? Evaluate the integrals.

a) $\int 12x(x^2+1)^5\,dx$

b) $\int \frac{6}{1-3x}\,dx$

c) $\int x^3\sin(x^4)\,dx$

5. Evaluate the following indefinite integrals.

a) $\int 12x^3(x^2+1)^5\,dx$

b) $\int \frac{6x}{1-3x}\,dx$

c) $\int x^3\left[\sin(x^4)\right]^2\,dx$ (a trig identity might help)