Math 1431

Section 16679

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Questions?

Indefinite Integrals

$\int f(x)dx =$ the general antiderivative of f. Otherwise known as the integral of f.

$\int f(x)dx = F(x) + C$ where C is an arbitrary constant and $F(x)$ is the antiderivative of $f(x)$.

The indefinite integral is a family of functions.

The definite integral is a value.

Section 6.3 -Basic Integration Rules

$$\int x^p\,dx = \frac{x^{p+1}}{p+1} + C, \quad p \neq -1$$

$$\int \frac{1}{x}\,dx = \ln|x| + C$$

$$\int e^x\,dx = e^x + C$$

$$\int \frac{1}{1+x^2}dx = \arctan(x) + C$$

$$\int \frac{1}{\sqrt{1-x^2}}dx = \arcsin(x) + C$$

$$\int \frac{1}{a^2+x^2}dx = \frac{1}{a}\arctan\left(\frac{x}{a}\right) + C$$

$$\int \frac{1}{\sqrt{a^2-x^2}}dx = \arcsin\left(\frac{x}{a}\right) + C$$

Section 6.3 -Basic Integration Rules

$$\int \cosh(x)dx = \sinh(x) + C$$

$$\int \sinh(x)dx = \cosh(x) + C$$

$$\int \sin(x)dx = -\cos(x) + C$$

$$\int \cos(x)dx = \sin(x) + C$$

$$\int \sec^2(x)dx = \tan(x) + C$$

$$\int \csc^2(x)dx = -\cot(x) + C$$

$$\int \sec(x)\tan(x)dx = \sec(x) + C$$

$$\int \csc(x)\cot(x)dx = -\cot(x) + C$$

The fundamental theorem of calculus:

$$\int_a^x f(t)dt = F(x) - F(a), \quad \text{where } F'(t) = f(t)$$

Find the following by integrating and then taking the derivative:

$$\frac{d}{dx}\int_3^x (2t-4)dt$$

Find the derivative: $\dfrac{d}{dx}\displaystyle\int_{2x}^{x^2}(3t^2-4t)dt.$

Integrate:

1. $$\int_3^{10} 4\,dx =$$

2. $$\int_1^8 x^{1/3}\,dx =$$

3. $$\int_1^{32} \frac{1}{\sqrt[5]{x}}\,dx =$$

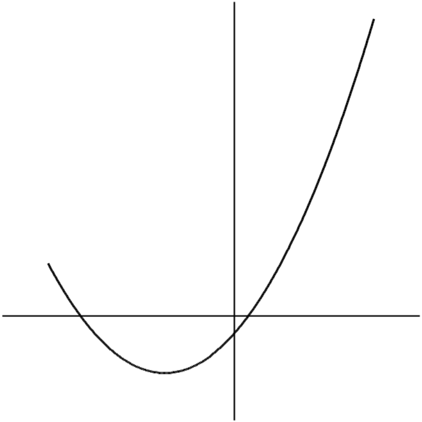
Section 6.1 - 6.3 Review

Recall that $\int_a^b f(x)dx = F(b) - F(a)$ where $F(x)$ is an antiderivative of $f(x)$.

If f is non-negative on the interval $[a, b]$, we get **area**.

In the general case, we get **net area**.

The graph of $y = f(x)$ is shown on the interval from $[-4, 3]$. Determine whether $\int_{-4}^{3} f(x)dx$ is positive or negative. Explain.



Section 6.1 - 6.3 Review

If $\int_0^3 f(x)dx = 12$ and $\int_0^6 f(x)dx = 42$, find the value of $\int_3^6 (2f(x) - 3)dx$.

Section 6.1 - 6.3 Review

Evaluate: $\int_{-6}^{6} |x^2 - 25| dx$

Evaluate: $\int_{-2}^{2} f(x)dx$ if $f(x) = \begin{cases} x+2 & -2 \le x \le 0 \\ 2 & 0 < x \le 1 \\ 4-2x & 11 < x \le 2 \end{cases}$

How would you approach these?

$$\int_0^1 \left(x^3+2\right)^3 \cdot 3x^2\,dx$$

$$\int 2x \cdot \sqrt{x^2+2}\,dx$$

U-Substitution

Recall the chain rule: $\dfrac{d}{dx}\left(f(g(x))\right) = f'(g(x)) \cdot g'(x)$

When integrating a composite function, we let the variable $u = g(x)$. All x's in the integrand must be changed to be in terms of u including dx.

What we do:

- Let $u =$ part "inside" of another function
- Find the derivative of u (don't forget the du)
- Substitute
- Change endpoints of integration if you have a definite integral
- Integrate

Examples:

1. $\int x^3(2x^4-1)^7dx$

2. $\int_0^2 x^2\sqrt{x^3+1}\,dx$

3. $\int x\cos(x^2)dx$

4. $\int \sec^2(3x)dx$

Section 6.4 - Integration by Substitution

5. $\displaystyle\int \frac{e^x}{1+e^{2x}}dx$

6. $\int \frac{\cos(x)}{\sqrt{2+\sin(x)}}dx$

7. $\int_0^{\pi/6} 5\sin^3(3x)\cos(3x)dx$

8. $\displaystyle\int_0^1 \frac{x}{\sqrt{1-x^4}}dx$

Popper 22

1. $\displaystyle\int \sin^3(x)\cos(x)dx =$

To Do

Read sections 6.1-6.4.

Work quizzes 22, 23, 24, 25 and 26.

Email me questions to put in the notes.