4.9 – Antiderivatives

Def'n: A function $F(x)$ is an antiderivative of $f(x)$ if $F'(x) = f(x)$.

Ex4.10) Find three antiderivatives of $f(x) = \cos(2x)$.

Remark: The general antiderivative of $f(x)$ is $F(x) + c$, where c is a constant.

Ex4.11) Find the general antiderivative of $f(x) = \sec^2 x$.

Ex4.12) Find the antiderivative of $f(x) = \dfrac{1}{2\sqrt{x}}$ that satisfies $F(4) = 0$.

Remark: There are many nice rules for differentiation: constant multiple, product, power, quotient, chain, etc. There are not so many nice rules for antidifferentiation. But…

Antidifferentiation Rules:

1. Constant Multiple:

2. Sum/Difference:

3. Power Rule:

Ex4.13) Find the general antiderivatives of:

1. $f(x) = 6x$

2. $f(x) = x^7$

3. $f(x) = x^7 - 6x + 8$

4. $f(x) = \frac{2}{x^3}$

5. $f(x) = \frac{4}{3}\sqrt[3]{x}$

6. $f(x) = \frac{1}{2\sqrt{x}}$

7. $f(x) = \pi \cos(\pi x)$

8. $f(x) = \csc x \cot x$

9. $f(x) = 34e^x$

10. $f(x) = \dfrac{x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$

11. A rocket lifts off from Earth at an acceleration of 20m/s^2. How fast will the rocket be going 1 minute later?

Def'n: The set of all antiderivatives of a function $f(x)$ is called the indefinite integral of f. It is denoted $\int f(x)dx$

$\int$ is an integral sign. The function $f(x)$ is called the integrand.

Ex4.14)

1. $\int (3x + 2)dx$

2. $\int (32x^5 - 18x^3)dx$

3. $\int\left(\frac{2}{x^3}-\frac{7}{4}\sqrt[3]{x^5}\right)dx$

4. $\int \cos x\,dx$

5. $\int\left(3e^x-\frac{3}{x}\right)dx$

Practice: 4.9 ODDS