Calculus for life Sciences

Section 7.1

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Find the derivative of each function

$y = 2x^2$

$4x$

$y = 12x + 2(x - 3)^2$

$12x + 2(x^2 - 6x + 9)$

$2x^2 + 18$

$12 + 4(x - 3)$

$12 + 4x - 12$

$4x$

$y = {}^1/_8(7 - 4x)^2 + 7x$

$\frac{1}{8}(49 - 56x + 16x^2) + 7x$

$\frac{49}{8} + 2x^2$

$\frac{1}{4}(7 - 4x)(-4) + 7$

$-(7 - 4x) + 7$

$-7 + 4x + 7$

$4x$

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Antiderivatives:

If F'(x) = f(x), *then* F(x) *is an antiderivative of* f(x).

Multiple functions might have the same derivative function. If F'(x) = f(x) *and* G'(x) = f(x), *then the following must be true:*

$$F(x) - G(x) = C$$

where C is some constant value.

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Indefinite Integral:

If F'(x) = f(x), *then:*

$$\int f(x)\,dx = F(x) + C$$

where C is some constant value.

$$\int F'(x)\,dx = F(x) + C$$

$$\int 4x\,dx = 2x^2 + C$$

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Power Rule for Integrals:

For any real number n ≠ -1*:*

$$\int x^n \, dx = \frac{x^{n+1}}{n+1} + C$$

where C is some constant value.

Constant Multiple Rule for Integrals:

$$\int k \cdot f(x) \, dx = k \cdot \int f(x) \, dx$$

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Evaluate each integral:

$\int 5x^4 \, dx$

$5 \frac{x^5}{5}$

$x^5 + C$

$\int 2x^2 \, dx$

$\frac{2x^3}{3} + C$

$\int x^{2.7} \, dx$

$\frac{x^{3.7}}{3.7} + C$

$\int 7/x^3 \, dx$

$7 \int x^{-3} \, dx$

$\frac{7x^{-2}}{-2} + C$

$\int \sqrt[3]{x^4} \, dx$

$\int x^{4/3} \, dx$

$\frac{x^{7/3}}{7/3}$

$\frac{3x^{7/3}}{7}$

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Sum/Difference Rule for Integrals:

$$\int f(x) \pm g(x)\,dx = \int f(x)\,dx \pm \int g(x)\,dx$$

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Evaluate each integral:

$\int 5x^6 - 16x + 2\,dx$

$5\frac{x^7}{7} - \frac{16x^2}{2} + 2x + C$

$\frac{5}{7}x^7 - 8x^2 + 2x + C$

$\int 9x^{13} - 4x^{11} - x^{-22}\,dx$

$\frac{9x^{14}}{14} - \frac{4x^{12}}{12} - \frac{x^{-21}}{-21} + C$

$\frac{9}{14}x^{14} - \frac{x^{12}}{3} + \frac{x^{21}}{21} + C$

$\int \sqrt[4]{x} + \sqrt{x} + x\,dx$

$\frac{x^{5/4}}{5/4} + \frac{x^{3/2}}{3/2} + \frac{x^2}{2} + C$

$\frac{4}{5}x^{5/4} + \frac{2}{3}x^{3/2} + \frac{x^2}{2} + C$

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Exponential Rules for Integrals:

$$\int e^{kx}\,dx = \frac{e^{kx}}{k} + C$$

$$\int a^{kx}\,dx = \frac{a^{kx}}{k(\ln a)} + C$$

where C is some constant value and $a \neq 1$.

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Evaluate each integral:

$\int 5x^6 - e^x + 2e^{2x}\,dx$

$\frac{5x^7}{7} - e^x + \frac{2e^{2x}}{2} + C$

$\frac{5}{7}x^7 - e^x + e^{2x} + C$

$\int ex^{10} - e^{10x} - 10ex + 10 - e\,dx$

$\frac{ex^{11}}{11} - \frac{e^{10x}}{10} - \frac{10ex^2}{2} + 10x - ex + C$

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Special case for n = -1:

$$\int x^{-1}\,dx = \ln x + C$$

where C is some constant value.

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

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Evaluate each integral:

$\int x^7 - 6x^{-1} + x^{-2}\,dx$

$\frac{x^8}{8} - 6\ln x + \frac{x^{-1}}{-1} + C$

$\int \frac{14 - x^2 - xe^x - \sqrt{x^7}}{x}\,dx$

$\int \frac{14}{x} - x - e^x - x^{5/2}\,dx$

$14\ln x - \frac{x^2}{2} - e^x - \frac{x^{7/2}}{7/2} + C$

$\int {}^1/_{\sqrt[4]{x}} + {}^3/_{\sqrt[3]{x}}\,dx$

$x^{-1/4} + 3x^{-1/3}$

$\frac{x^{3/4}}{3/4} + \frac{3x^{2/3}}{2/3} + C$

$\frac{4x^{3/4}}{3} + \frac{9x^{2/3}}{2} + C$

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