

## Math 285 — Review practice problem solutions.

**Partial fractions:**  $A = -1$  and  $B = 1$ , so

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

**Properties of the exponential and the logarithmic functions:**

$$e^{x+2} = e^x + e^2 : \text{False}; \quad e^{x+2} = e^x e^2 : \text{True}; \quad (e^x)^2 = e^{2x} : \text{True}$$

$$\ln(3x) = \ln(3) + \ln(x) : \text{True}; \quad \ln(3x) = \ln(3) \ln(x) : \text{False}$$

$$4 \ln(x) = \ln(x^4) : \text{True}; \quad \ln(x/2) = \ln x - \ln 2 : \text{True}; \quad e^{2 \ln(x)} = x^2 : \text{True}$$

**Complex numbers:**

$$(4+2i)(1-3i) = 10-10i; \quad (5-xi)(5+xi) = 25+x^2; \quad (3-2i)^2 = 5-12i$$

**Simple algebraic linear system**

$$\begin{aligned} x + y &= 3 \\ 2x - 3y &= -4 \end{aligned}$$

Solution:  $x = 1, y = 2$

$$\begin{aligned} x + 2y + z &= 1 \\ x + 2z &= 5 \\ y - z &= -3 \end{aligned}$$

Solution:  $x = 1, y = -1, z = 2$

**Derivatives of common functions and rules:**

Calculate the derivative with respect to  $x$  of  $y(x)$  for each of the following cases.

$$y(x) = x^3 + 4x; \quad y'(x) = 3x^2 + 4$$

$$y(x) = e^{2x}; \quad y'(x) = 2e^{2x}$$

$$y(x) = \ln(3x); \quad y'(x) = \frac{1}{x}$$

$$y(x) = \sqrt{x^2 - 1}; \quad y'(x) = \frac{x}{\sqrt{x^2 - 1}}$$

$$y(x) = \sin(x); \quad y'(x) = \cos(x)$$

$$y(x) = \cos(2x); \quad y'(x) = -2\sin(2x)$$

$$y(x) = x^2 \cos(x); \quad y'(x) = 2x \cos(x) - x^2 \sin(x)$$

$$y(x) = x \ln(x); \quad y'(x) = \ln(x) + 1$$

$$y(x) = \frac{\ln(x)}{x}; \quad y'(x) = \frac{1}{x^2} - \frac{\ln(x)}{x^2}$$

$$y(x) = \ln(\sin(\sqrt{x^2 - 4})); \quad y'(x) = \frac{x}{\sqrt{x^2 - 4}} \cot(\sqrt{x^2 - 4})$$

**Integrals of common functions and rules:**

$$\int x e^x dx = x e^x - e^x$$

$$\int x^2 e^{3x} dx = \left( \frac{x^2}{3} - \frac{2x}{9} + \frac{2}{27} \right) e^{3x}$$

$$\int \frac{1}{(1+2x)} dx = \frac{1}{2} \ln(1+2x)$$

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

$$\int \frac{1}{(3+x)(2-x)} dx = \frac{1}{5} \ln\left(\frac{3+x}{2-x}\right)$$

$$\int x \cos(2x) dx = \frac{x}{2} \sin(2x) + \frac{1}{4} \cos(2x)$$

$$\int x^2 \sin(3x) dx = -\frac{x^2}{3} \cos(3x) + \frac{2x}{9} \sin(3x) + \frac{2}{27} \cos(3x)$$