

# Calculus A II One-to-One Tutoring

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**Question 2.1** (Some Basic Derivatives).

Find the derivative with respect to  $x$  for the following functions:

- |                |                  |                     |                       |
|----------------|------------------|---------------------|-----------------------|
| 1. $y = x^n$ ; | 3. $y = a^x$ ;   | 5. $y = \log_a x$ ; | 7. $y = \cos x$ ; and |
| 2. $y = e^x$ ; | 4. $y = \ln x$ ; | 6. $y = \sin x$ ;   | 8. $y = \tan x$ ;     |

**Question 2.2** (Utilizing the Chain Rule).

Find the derivative of the following functions:

1.  $y = \sqrt[3]{e^x + 1}$ ;

2.  $y = e^{\tan \theta}$ ;

3.  $y = \sin \left( \frac{e^x}{1 + e^x} \right)$ ;

4.  $y = t \sin(\pi t)$ ;

5.  $y = \sin(\ln x)$ ;

6.  $y = \ln \left( \frac{x^a}{b^x} \right)$ ;

7.  $y = \frac{1}{\ln x}$ ;

8.  $y = \ln \left( (\sin x)^2 \right)$ ; and

9.  $y = \frac{\ln x}{1 + \ln x}$ .

**Question 2.3** (Applying the Chain Rule).

Use the fact that  $|x| = \sqrt{x^2}$  to find  $\frac{d}{dx} (|x|)$ .

**Question 2.4** (Applying the Chain Rule).

Find the derivative of  $y = x^x$ . (Hint: take log to both sides.)

**Question 2.5** (Comprehensive Applications).

Find the derivative of the following functions:

1.  $y = \sqrt[4]{x^3 \sqrt{x \sqrt{x}}}$ ;

2.  $y = (x - 3)\sqrt{x^2 + 2x + 3}$ ;

3.  $y = x^{(\ln x)^{111}}$ ;

4.  $y = \cos(\sin 3x)$ ;

5.  $y = e^t(1 + te^t)$ ;

6.  $y = x^3 e^x$ ;

7.  $y = \frac{x}{e^x}$ ; and

8.  $y = \frac{e^x}{1 - e^x}$ .

**Example 2.6.**

Compute  $\frac{d}{dx} (\sin (\cos 5x))$ .

**Example 2.7.**

Compute  $\frac{d}{dx} (\sin (3 \cos x))$ .

**Example 2.8.**

Compute  $\frac{d}{dx} (\sin (\cos bx))$  for  $b \in \mathbb{R}^+$ .

**Example 2.9.**

Compute  $\frac{d}{dx} (\sin (a \cos x))$  for  $a \in \mathbb{R}^+$ .

**Example 2.10.**

Compute  $\frac{d}{dx} (\sin (a \cos bx))$  for  $a, b \in \mathbb{R}^+$ .

**Example 2.11.**

Compute  $\frac{\partial w}{\partial x}$  for  $w = \sin (y \cos x)$ .

**Example 2.12.**

Compute  $\frac{\partial w}{\partial x}$  for  $w = z \sin (\cos x)$ .

**Example 2.13.**

Compute  $\frac{\partial w}{\partial x}$  for  $w = z \sin (y \cos x)$ .

**Example 2.14.**

Find the first partial derivatives of the following functions:

1.  $w = x^4 + 5xy^3;$

2.  $w = x^2y - 3y^4;$

3.  $w = x^3 \sin y;$

4.  $w = e^{xt};$

5.  $w = \ln(x + t^2);$

6.  $w = \frac{e^x}{u + v^2};$

7.  $w = x^y;$  and

8.  $w = \ln(x + 2y + 3z).$