

✓ Congratulations! You passed!

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1. Which of the following represents the derivative of a function $f(x)$ (check all that apply)? **1 / 1 point**

☐ $F(x)$

☒ $f'(x)$

✓ **Correct**
Correct!

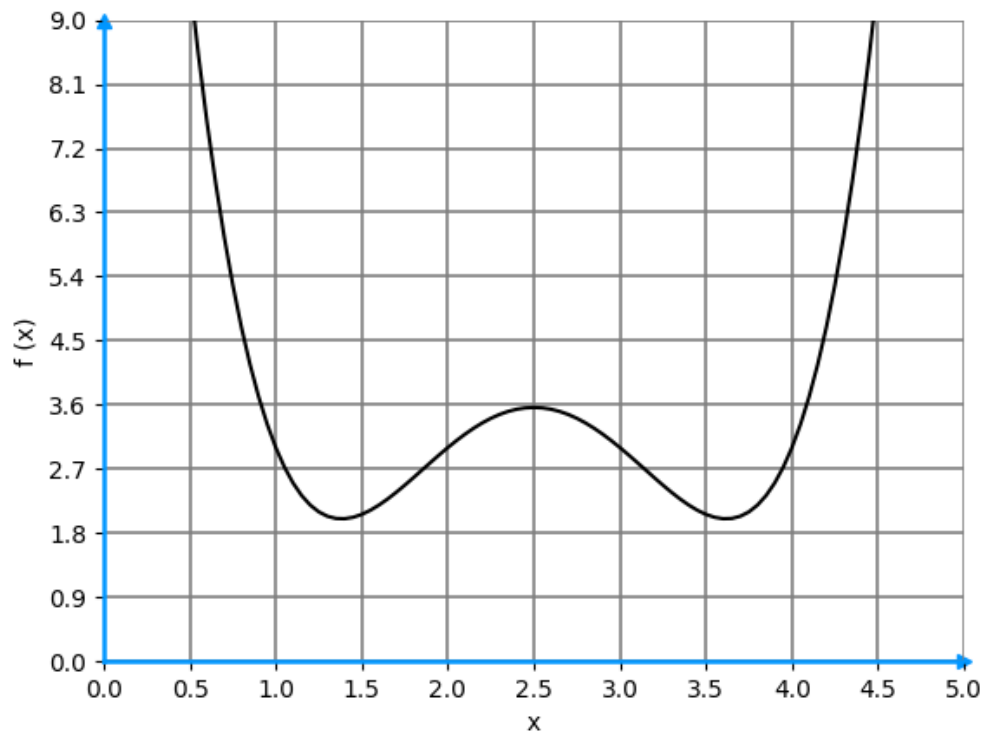
☐ $f'(x^2)$

☒ $\frac{df(x)}{dx}$

✓ **Correct**
Correct! This is known as the Leibniz notation.

☐ $\frac{f(x)}{df(x)}$

2. Consider the graph of the following function $f(x)$. **1 / 1 point**



Regarding **its derivative**, $f'(x)$, where $x \in [0, 5]$: (check all that apply)

☐ $f'(x)$ is always positive.

☒ $f'(x)$ has three zeros, i.e., $f'(x) = 0$ three times.

⊙ **Correct**

Correct! f has two local minima and one local maximum in the interval.

☐ $f'(x)$ has two zeros, i.e., $f'(x) = 0$ twice.

☒ $f'(1) < 0$.

**Correct**

Correct! f is decreasing when $x = 1$, therefore its derivative must be negative at this point.



$f'(4) > 0.$

**Correct**

Correct. f is increasing when $x = 4$, therefore its derivative must be positive at this point.

3. What is the derivative of $3x^3 - 2x + 1$?

1 / 1 point

☐ $3x^2 - 2$

☐ $9x^2 - 2 + 1$

☒ $9x^2 - 2$

☐ $9x^3 - 1$

**Correct**

Correct!

4. Suppose you have a game where you toss a coin 20 times and win if you get, in this exact order, 16 heads and 4 tails. However, in this game, you can choose any coin and toss it 20 times.

1 / 1 point

Which of the following functions you need to maximize in order to find the best coin for this game? Consider p being the probability of a given coin being heads.

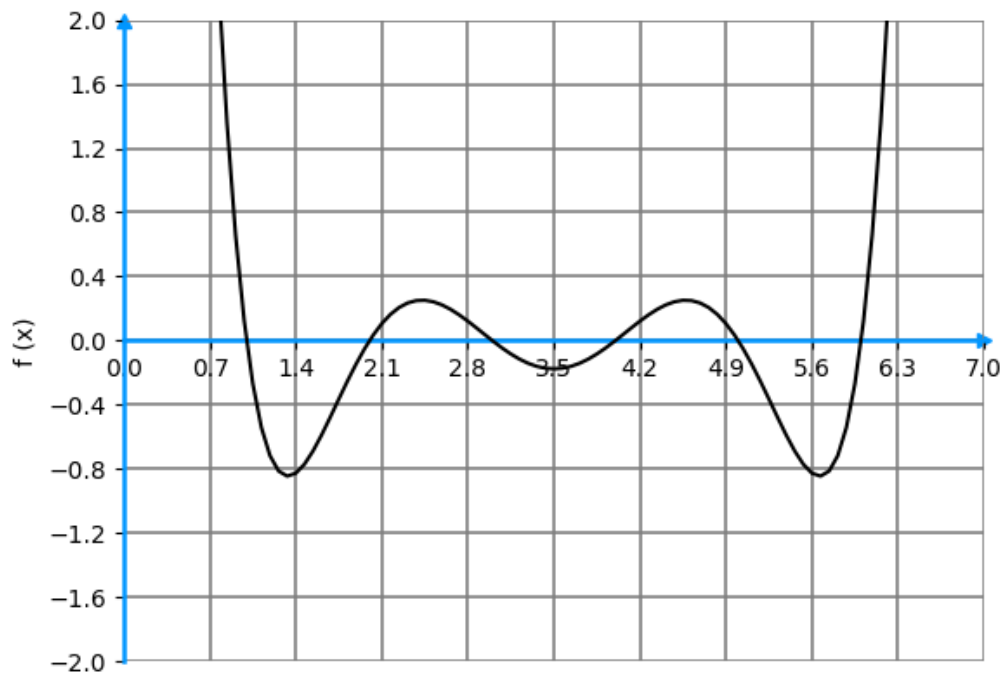
- ☐ $16 \log(p) + 4 \log(p)$
- ☒ $16 \log(p) + 4 \log(1 - p)$
- ☐ $4 \log(p) + 16 \log(1 - p)$
- ☐ $4 \log(1-p) + 16 \log(1-p)$

☒ **Correct**

Correct! The probability of having 16 heads is p^{16} and the probability of having 4 tails is $(1 - p)^4$, therefore the total desired probability is $l(p) = p^{16}(1 - p)^4$. As you saw in the lecture Cost Functions in machine Learning - Part II, the same value that maximizes l , also maximizes $\log l$ and $\log l = 16 \log(p) + 4 \log(1 - p)$.

5. Let $f(x)$ be a real valued function with the following graph. In the interval $[0, 7]$, how many zeros has its derivative $f'(x)$?

1 / 1 point



5

**Correct**

Correct! Since f has 3 local minima and 2 local maxima in the desired interval, it must have 5 zeros. You can review the lecture [Introduction to Optimization](#) to get more details.

6. If $f(x)$ and $g(x)$ are differentiable functions, then the derivative of $f(x)g(x)$ is given by:

1 / 1 point

☒ $f'(x) \cdot g(x) + g'(x) \cdot f(x)$

☐ $f'(x) \cdot g'(x) + f(x) \cdot g(x)$

☐ $f'(x) \cdot g(x) - f(x) \cdot g'(x)$

☐ $f'(x) \cdot g'(x)$

☒ **Correct**
Correct!

7. The **rate of change** of $f(x) = x^2 + 3$ at $x = 6$ is:

1 / 1 point

12

☒ **Correct**
Correct! $f'(x) = 2x$, therefore $f'(6) = 2 \cdot 6 = 12$.

8. Let $f(x)$ be a **positive** real function and $g(x) = \log f(x)$.

0.5 / 1 point

Check all that apply.

☒ $\frac{df(x)}{dx} = \frac{dg(x)}{dx}$

☒ **This should not be selected**
Incorrect! There is no guarantee that the derivative of g will be the same as f 's.

☐ If x_{max} is a point where $f(x_{max})$ is a local maximum, then $g(x_{max})$ is also a local **maximum**.

☐ If x_{max} is a point where $f(x_{max})$ is a local maximum, then $g(x_{max})$ is also a local **minimum**.

☒ If $f(x)$ is differentiable, then so is $g(x)$.

☒ **Correct**

Correct! The result of composing two differentiable functions is differentiable, by the **chain rule**.

9. Using the **chain rule**, the derivative of e^{-x} is:

1 / 1 point

☐ e^{-x}

☐ $-e^x$

☒ $-e^{-x}$

☐ e^x

☒ **Correct**

Correct!