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

- [ ] $F(x)$
- [x] $f'(x)$

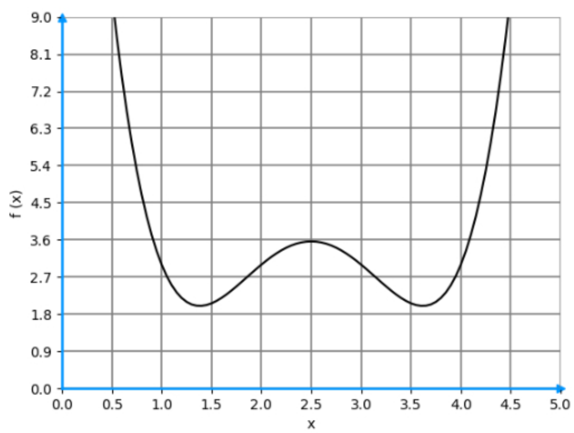
Correct
Correct!

- [ ] $f'(x^2)$
- [x] $\frac{df(x)}{dx}$

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.
- [x] $f'(x)$ 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.
- [x] $f'(1) < 0$.

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

- [x] $f'(4) > 0$.

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

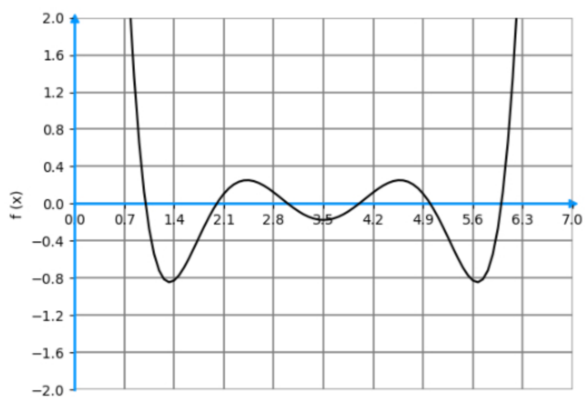
Which of the following functions you need to maximize in order to find the best coin for this game? Consider p being the probability of a given coin being heads.

- ○ $16\log(p) + 4\log(p)$
- ◉ $16\log(p) + 4\log(1 - p)$
- ○ $4\log(p) + 16\log(1 - p)$
- ○ $4\log(1 – p) + 16\log(1 – p)$

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 $g(x) = \log f(x)$.

1 / 1 point

Check all that apply.

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

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

Correct
Correct! When applying the function log to f, even though we change its shape, the maximum points will remain the same, since $\log$ is a **crescent** function!

☐ 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!