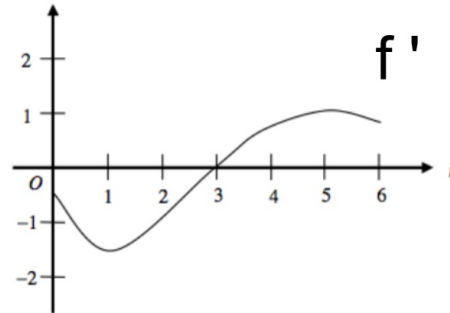


## WARM UP

Given the graph of the derivative of  $f$ ,  
answer the following questions.  
Justify all your answers.



1. Identify all relative extrema.
2. Identify points of inflection.
3. Identify on which interval(s) is  $f$  decreasing.
4. Identify on which interval(s) is the graph of  $f$  concave down.

# u-Substitution:

## Indefinite Integration Edition (Day One)

Objective:

- Integrate functions using u-substitution (u-sub)

# u-Substitution Notation

$$\int f(g(x))g'(x) dx = F(g(x)) + C.$$

Letting  $u = g(x)$  gives  $du = g'(x) dx$  and

$$\int f(u) du = F(u) + C.$$

**U-Sub is the chain rule for integration.**

## Basic steps for u-sub

GOAL: rewrite the integrand in terms of  $u$  and  $du$  (a function with its derivative). You might need to add a constant to replace all parts.

1. Define  $u$ . It's usually what's inside ( ), under the radical, or trig angle (inside function).
2. Take the derivative to find  $du$ , in terms of  $dx$ .
3. Integrate your new expression. In final answer, sub back in for  $u$ .

Two more important integration formulas.

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

$$\int e^x dx = e^x + C$$

Ex.1:  $\int 3x^2(x^3 - 13)^{24} dx$

$$\text{Ex. 2: } \int 2x \cos(x^2) dx$$

$$\text{Ex. 3: } \int 3x \sin(x^2 + 1) dx$$

Ex. 4:  $\int \tan x dx$

Ex. 5:  $\int \frac{e^{\frac{1}{x}}}{x^2} dx$

Ex. 6:  $\int \frac{x}{x^2 - 4} dx$

Ex. 7:  $\int x\sqrt{x^2 - 2} dx$

Ex. 8:  $\int \sin^3 x \cos x \, dx$