WARMUP

16. If the line tangent to the graph of the function f at the point (1,7) passes through the point (-2,-2), then $f'(1)$=

(A) –5 (B) 1 (C) 3 (D) 7 (E) undefined

17. Let f be the function given by $f(x)=2xe^{x}$. The graph of f is concave down when :

(A) $x < -2$ (B) $x > 2$ (C) $x < -1$ (D) $x > -1$ (E) $x < 0$

WARMUP—Start New Answer Sheet

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HW Questions?

AP Calculus BC

Euler's Method

Something New!

Please take notes. ☺

Background Info

- Tangent lines approximate values on a curve.
  - The closer to the point of tangency, the better the approx.

$$y - f(x_0) = f'(x_0) \quad x - x_0$$

is the equation of the tangent line to the curve defined by $f(x)$ at the point $(x_0, f(x_0))$

  - Also, referred to as the “linearization” of the curve

Basis of Euler’s Method

- Patching together a string of small linearizations to approximate the curve over a larger stretch

Patching together a string of small linearizations

Given $\frac{dy}{dx} = f'(x, y)$ and $y(x_0) = y_0$

(i.e. A differential equation with the condition that (x_0, y_0) is on the curve defined by $f(x, y)$. This differential equation is the slope of the curve and depends upon x and y.)

Euler’s (“Oiler’s”) Method

- Used to approximate a specific solution to a differential equation
  - This is especially useful if the differential equation can not be separated and integrated

- Approximation is based on past events

What Euler's did . . .

- Used the point slope equation of a line to approximate future y-value based on previous y-value

Slope at previous point

$$y_n \approx y_{n-1} + f^{'}(x_{n-1}, y_{n-1})\Delta x$$

Future y-value

Previous y-value

Step size

Example Problem:

Use Euler's Method to Approximate $f(0.2)$ given the following:

$$\frac{dy}{dx} = f^{'}(x, y) = x + y; \quad y(0) = 1; \quad \Delta x = 0.1$$

$$y_n \approx y_{n-1} + f^{'}(x_{n-1}, y_{n-1})\Delta x$$

$$\frac{dy}{dx} = f'(x, y) = x + y; \quad y(0) = 1; \quad \Delta x = 0.1 \quad f(0.2) = ?$$

$$y_n \approx y_{n-1} + f'(x_{n-1}, y_{n-1})\Delta x$$

Use Euler's Method with step size $\Delta x =$ 1/4 to estimate y(3/4) in the initial value problem dy/dx=y with initial condition y(0)=1.