

7. Differential Equations

Starter Quiz

AP Calculus BC

Name: _____ Score: _____

1. A differential equation relates a function to its...

- ☐ inverse
- ☐ derivatives
- ☐ reciprocal
- ☐ domain

2. To verify a candidate solution, you...

- ☐ graph it
- ☐ plug in one value of x
- ☐ differentiate it and substitute into the equation
- ☐ integrate both sides

3. For $\frac{dy}{dx} = x + y$, find the slope of the dash at the point $(2, 3)$.

4. A solution curve through the slope field must always stay...

- ☐ perpendicular to the dashes
- ☐ tangent to the dashes
- ☐ horizontal
- ☐ a straight line

5. Euler's update rule is $y_{n+1} =$

- ☐ $y_n \cdot h f(x_n, y_n)$
- ☐ $y_n + h f(x_n, y_n)$
- ☐ $h f(x_n, y_n)$
- ☐ $y_n + f(x_n, y_n)$

6. Which equation is separable?

- ☐ $\frac{dy}{dx} = x^2 + y^2$
- ☐ $\frac{dy}{dx} = xy$
- ☐ $\frac{dy}{dx} = x + y$

☐ $\frac{dy}{dx} = \sin(x + y)$

7. For $y = x^2 + C$ with $y(1) = 5$, find C .

8. Exponential decay occurs when k is _____ (its sign).

9. For $\frac{dP}{dt} = 0.1P(1 - \frac{P}{2000})$, what is the carrying capacity L ?

10. $y = kt$ (with no derivative) is a differential equation.

- ☐ True ☐ False

AP Calculus BC

1. **derivatives**

It involves the function and its derivative(s).

2. **differentiate it and substitute into the equation**

Differentiate the candidate, substitute, check both sides match.

3. **5**

$2 + 3 = 5$.

4. **tangent to the dashes**

It follows the tangent directions.

5. $y_n + h f(x_n, y_n)$

Old y plus slope times step.

6. $\frac{dy}{dx} = xy$

xy factors as $(x\text{-part}) \times (y\text{-part})$; a sum does not.

7. **4**

$5 = 1 + C \Rightarrow C = 4$.

8. **negative**

$k < 0$ makes e^{kt} shrink toward 0.

9. **2000**

$L = 2000$, the long-term limit.

10. **False**

A differential equation must involve a derivative.