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 $\dfrac{dy}{dx} = x + y$, 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?

   ☐ $\dfrac{dy}{dx} = x^2 + y^2$

   ☐ $\dfrac{dy}{dx} = xy$

   ☐ $\dfrac{dy}{dx} = x + y$

☐ $\dfrac{dy}{dx} = \sin(x + y)$

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

   _____

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

   _____

9. For $\dfrac{dP}{dt} = 0.1P(1 - \frac{P}{2000})$, 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. $\dfrac{dy}{dx} = xy$

   xy factors as (x-part)×(y-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.