7. Differential Equations

Starter Quiz · 课前小测

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...

   ☐ integrate both sides

   ☐ differentiate it and substitute into the equation

   ☐ plug in one value of x

   ☐ graph it

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 $y_{n+1} =$

   ☐ $y_n \cdot h\, f(x_n, y_n)$

   ☐ $y_n + h\, f(x_n, y_n)$

   ☐ $y_n + f(x_n, y_n)$

   ☐ $h\, f(x_n, y_n)$

6. Which equation is separable?

   ☐ $\dfrac{dy}{dx} = x + y$

   ☐ $\dfrac{dy}{dx} = xy$

   ☐ $\dfrac{dy}{dx} = x^2 + y^2$

☐ $\dfrac{dy}{dx} = \sin(x+y)$

7. $y = e^{3x}$ is a solution of $\dfrac{dy}{dx} = 3y$.

   ☐ True ☐ False

8. Two different solution curves of the same equation can cross each other.

   ☐ True ☐ False

9. For $\dfrac{dy}{dx} = x + y$, $y(0) = 1$, $h = 0.5$: the slope at $(0, 1)$ is 1. Find y_1.

   _____

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

    _____

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Answers · 答案

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. **True**

   $\frac{dy}{dx} = 3e^{3x} = 3y$. ✓

8. **False**

   Each point has one slope, so solution curves never cross.

9. **1.5**

   $1 + 0.5(1) = 1.5$.

10. **4**

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