Differential equations and volume Worksheet

AP and College Calculus

Name _____ Date _____

Warm-up

1. Which is a solution of $\frac{dy}{dx} = 6y$?
   (A) $y = e^{6x}$ (B) $y = x^6$ (C) $y = 6x$ (D) $y = e^x + 6$

2. A disc's area with radius $f(x)$ is:
   (A) $\pi f(x)$ (B) $f(x)^2$ (C) $\pi f(x)^2$ (D) $2\pi f(x)$

3. $\frac{dy}{dx} = 2x$ and $y(0) = 3$. Find $y(5)$.

4. With a hole, the slice is called a:
   (A) Disc (B) Washer (C) Ring sum (D) Shell

5. $\frac{dy}{dx} = 4$ and $y(0) = 9$. Find $y(1)$.

Practice

6. $\frac{dy}{dx} = 3x^2$ and $y(1) = 3$. Find C in $y = x^3 + C$.

7. Rotate $y = x$ from 0 to 3. The volume is $k\pi$. Find k.

8. $\frac{dy}{dx} = \frac{x}{y}$ at $(9, 6)$. Find the slope. Write a fraction.

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9. A washer has $R = 7$ and $r = 2$ and width 1. Its volume is $k\pi$. Find k.

10. $y = 39e^{kt}$. What's $y(0)$?

11. Rotate $y = \sqrt{x}$ from 0 to 8. The volume is $k\pi$. Find k.

Challenge

12. $\dfrac{dy}{dx} = 8y$, and at some moment $y = 19$. What's the rate then?

13. Between $y = 7$ and $y = 5$ from 0 to 5, rotated. Volume is $k\pi$. Find k.

14. A quantity doubles every 4 hours and starts at 13. Find the amount after 12 hours.

15. Why is the sphere's volume found with $\pi \int_{-r}^{r} (r^2 - x^2)\, dx$?

    (A) It's an area of a circle only (B) It adds up circumferences (C) It uses washers with holes (D) Each slice is a disc with radius^2 of $r^2 - x^2$

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Differential equations and volume Worksheet: Answer Key

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1. (A) $y = e^{6x}$

   Its derivative is 6 times itself.

2. (C) $\pi f(x)^2$

   Circle area.

3. 28

   $y = x^2 + 3$.

4. (B) Washer

   Outer minus inner.

5. 13

   $y = 4x + 9$.

6. 2

   $3 = 1 + C$.

7. 9

   $\int_0^3 x^2\,dx = \frac{3^3}{3}$.

8. $\frac{3}{2}$

   Substitute into the equation.

9. 45

   $7^2 - 2^2$.

10. 39

    $e^0 = 1$.

11. 32

    $\int_0^8 x\,dx = \frac{8^2}{2}$.

12. 152

    Multiply.

13. 120

    $(R^2 - r^2)h$.

14. 104

    3 doublings.

15. (D) Each slice is a disc with radius^2 of $r^2 - x^2$

    From $x^2 + y^2 = r^2$, $y^2 = r^2 - x^2$.

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