AP Calculus Name: _____

Separable Differential Equations

Solve the differential equation by separation of variables.

1. $\frac{dy}{dx} = 2x^3 y$

2. $\frac{dy}{dx} = 2y - 4$

3. $(2+x)y' = 3y$

4. $yy' = \sin x$

5. $\sqrt{1-4x^2}\,y' = x$

6. $y\ln x - xy' = 0$

Find the particular solution that satisfies the given initial condition.

7. $yy' - e^x = 0$, $y(0) = 4$

8. $\sqrt{x} + \sqrt{y}y' = 0$, $y(1) = 4$

9. $\frac{dy}{dx} = \frac{x^2}{y}$ when y = -5 and x = 3

10. $\frac{dy}{dx} = 6x^2 y$ when x = 0 and y = 4

11. $\frac{dy}{dx} = -xy^2$, $y(1) = -0.25$

12. $y' = \frac{1+x}{\sqrt{y}}$, $y(2) = 9$

13. Which of the following is the solution to the differential equation $\frac{dy}{dx} = 2\sin x$ with the initial condition $y(\pi) = 1$?

(A) $y = 2\cos x + 3$ (B) $y = 2\cos x - 1$
(C) $y = -2\cos x + 3$ (D) $y = -2\cos x + 1$ (E) $y = -2\cos x - 1$

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14. If a function $y = f(x)$ satisfies the differential equation $\frac{dy}{dx} = -4y$ and $f(0) = 6$, then $f(x) =$

(A) $-2x^2 + 6$ (B) $-\frac{x}{4} + 6$
(C) $6e^{-4x}$ (D) $e^{-4x} + 5$ (E) $-\frac{1}{4}\ln\left(x + e^{-24}\right)$

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15. The solution to the differential equation $\frac{dy}{dx} = \frac{x}{\cos y}$ with the initial condition $y(1) = 0$ is

(A) $y = \sin^{-1}\left(\frac{x^2 - 1}{2}\right)$ (B) $y = \sin^{-1}\left(\frac{x^2}{2}\right)$
(C) $y = \cos^{-1}\left(x^2 - 2\right)$ (D) $y = \ln[\cos(x-1)]$ (E) $y = \ln(\sin x)$

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16. A particle moves along the y-axis with velocity given by $v(t) = 4(y+5)t^3$ and an initial velocity of $y(0) = 8$. Which of the following is an expression for the position of the particle over time $y(t)$?

(A) $y(t) = 8e^{t^4} - 5$ (B) $y(t) = 13e^{t^4} - 5$
(C) $y(t) = \ln|8t^4 - 5|$ (D) $y(t) = 13t^4 - 5$ (E) $y(t) = 12t^2 - 8$

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16. A calf that weighs 60 pounds at birth gains weight at the rate of $\frac{dw}{dt} = (1200 - w)$ where w is weight in pounds and t is time in years.

(A) Find an expression that gives the weight, W, of the calf over time t.

(B) If the animal is sold when its weight reaches 800 pounds, find the time of sale.