Find the derivative of each function.

1a) $y = e^{\sqrt{x}}$

$$\frac{dy}{dx} = \frac{e^{\sqrt{x}}}{2\sqrt{x}}$$

1b) $y = x^3 e^x$

1c) $g(t) = (e^{-t} + e^t)^3$

1d) $y = \dfrac{e^x + 1}{e^x - 1}$

2a) $y = 5^{-4x}$

$$y' = -4(\ln 5)5^{-4x}$$
$$= \frac{-4 \ln 5}{625^x}$$

2b) $g(t) = t^2 2^t$

2c) $h(\theta) = 2^{-\theta} \cos \pi\theta$

Find the equation of the tangent line at the given point of each function.

3a) $f(x) = e^{1-x}, \quad (1, 1)$

$$f'(x) = -e^{1-x}, \; f'(1) = -1$$

Tangent line: $y - 1 = -1(x - 1)$

$$y = -x + 2$$

3b) $y = x^2e^x - 2xe^x + 2e^x, \quad (1, e)$

Use implicit differentiation to find $\dfrac{dy}{dx}$.

4a) $xe^y - 10x + 3y = 0$

$$xe^y \frac{dy}{dx} + e^y - 10 + 3\frac{dy}{dx} = 0$$

$$\frac{dy}{dx}(xe^y + 3) = 10 - e^y$$

$$\frac{dy}{dx} = \frac{10 - e^y}{xe^y + 3}$$

4b) $e^{xy} + x^2 - y^2 = 10$

5a) The value ***V*** of an item ***t*** years after it is purchased is $V = 15{,}000e^{-0.6286t}$, $0 \le t \le 10$.

Find the rate of change of ***V*** with respect to ***t*** when $t = 5$.

5b) After ***t*** years, the value of a car purchased for \$20,000 is $V(t) = 20{,}000\left(\frac{3}{4}\right)^t$.
Find the rate of change of ***V*** with respect to ***t*** when $t = 4$. Label your answer and explain what it means in context to the problem.

6) AP MULTIPLE CHOICE EXAMPLES

1) $\frac{d}{dx}\left(2^x\right) =$

(A) 2^{x-1} (B) $(2^{x-1})x$ (C) $(2^x)\ln 2$ (D) $(2^{x-1})\ln 2$ (E) $\frac{2x}{\ln 2}$

2) If $y = x^2 e^x$, then $\frac{dy}{dx} =$

(A) $2xe^x$ (B) $x\left(x + 2e^x\right)$ (C) $xe^x\left(x+2\right)$

(D) $2x + e^x$ (E) $2x + e$

3) If $y = 10^{\left(x^2-1\right)}$, then $\frac{dy}{dx} =$

(A) $(\ln 10)10^{\left(x^2-1\right)}$ (B) $(2x)10^{\left(x^2-1\right)}$ (C) $\left(x^2-1\right)10^{\left(x^2-2\right)}$

(D) $2x(\ln 10)10^{\left(x^2-1\right)}$ (E) $x^2(\ln 10)10^{\left(x^2-1\right)}$

4) If $y = e^{nx}$, then $\frac{d^n y}{dx^n} =$

(A) $n^n e^{nx}$ (B) $n!e^{nx}$ (C) ne^{nx} (D) $n^n e^x$ (E) $n!e^x$