$y' = x^{2} + 2$

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I. Determine if true or false for each of the following statements (10 points each)

$y'' =$

1. **X/T** The second derivative of $y = 2e^{x^3}$ is $\frac{d^2y}{dx^2} = 6xe^{x^3}(2+3x^3)$ $y' = 6x^2 e^{x^3}$

$\ln y = \ln x^{2x}$
$\ln y = 2x \ln x$

-30 2. **F** The derivative of $6x - 4x^2y = 2y^2 + 1$ is $\frac{dy}{dx} = \frac{-6}{8x+4y}$

$6 - 8xy' - 4yy' = 1 - 6$

$\frac{y'}{y} = 2x \left(\frac{1}{x}\right)$

3. **F/T** The derivative of $y = x^{2x}$ is $y' = 2x^{2x}(\ln(x)+1)$

4. **X/F** A spherical balloon is being inflated with a gas at a rate of 6 cm³ per second. Then the rate at which its radius is changing when its radius measures 8 cm is $\frac{dr}{dt} = \frac{3\pi}{128} \left[\frac{cm}{sec}\right]$. (Hint: $V = \frac{4}{3}\pi r^3$)

II. Answer the following problem. (10 points each letter)
A dynamite charge blows a rock up with a velocity of 160 ft/s. The height of the rock is given by the function $h(t) = 160t - 16t^2$ where "h" is measured in feet and "t" in seconds. Find the following:

a) The equation that gives the velocity of the rock at any time.

$v(t) = -32t + 160$

b) The time when velocity is zero (that is the time to reach the maximum height)

$0 = -32t + 160$
$-160 = -32t$

$\frac{-160}{-32} = t$

$5s = t$

c) The maximum height of the rock (that is when velocity is zero)

$h(t) = 160(5) - 16(5^2)$
$h(t) = 800 - 400$

$h(t) = 400 ft$

d) The times (on the way up and on the way down) when the height is at 256 feet.

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $256 = 160t - 16t^2$

$-16t^2 + 160t - 256 = 0$

two times $x = \frac{-160 \pm \sqrt{(160)^2 - 4(-16)(-256)}}{2(-16)}$

$x = \frac{-160 \pm \sqrt{25,600 - 16,384}}{-32}$

$x = \frac{-160 \pm \sqrt{9,216}}{-32}$

$x = \frac{-160 + 96}{-32}$ $x = \frac{-160 - 96}{-32}$

$x_1 = 2$ $x_2 = 8$

e) The velocities of the rock when the height is 256 feet.

$v(t) = -32(2) + 160$ $v(t) = -32(8) + 160$
$v(t) = 96$ $v(t) = -96$

f) The equation that gives the acceleration of the rock at any time.

$a(t) = -32 ft/s^2$