

Name: SOLUTIONS

Student ID: _____

Quiz 7

This quiz is graded out of 10 marks. No books or notes are allowed. SHOW ALL YOUR WORK.
If you need more space for your answer use the back of the page.

Question 1. (10 marks)

A spherical balloon is inflated with gas at a rate of $250 \frac{\text{cm}^3}{\text{s}}$. How fast is the radius of the balloon increasing at the instant the radius is 10 cm ?

(Volume of Sphere: $V = \frac{4\pi}{3}r^3$ where r is radius)

Looking for $\frac{dr}{dt}$ when $r=10 \text{ cm}$

Given $\frac{dV}{dt} = 250 \text{ cm}^3/\text{s}$

$$V = \frac{4\pi}{3}r^3$$

differentiate with respect to t

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$250 = 4\pi(10)^2 \frac{dr}{dt}$$

$$\frac{dr}{dt} = \frac{250}{400\pi} = \boxed{\frac{5}{8\pi} \text{ cm/s}}$$

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Question 2. (5 marks)
Find the derivative of $f(x) = x^3\sqrt{x}$.

Product Rule

$$f'(x) = 3\sqrt{x} + \left[3\sqrt{x} (\ln 3) \frac{1}{2} x^{-1/2} \right] x$$

$$= 3\sqrt{x} + 3\sqrt{x} (\ln 3) x^{1/2}$$

Question 3. (5 marks)
Find the derivative of $f(x) = \log_5(x^2 + 3)$

$$f'(x) = \frac{1}{(x^2+3) \ln 5} \cdot 2x$$