

CALCULUS I -- Worksheet #58

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1. The population of a country is growing at a rate proportional to its population. If the growth rate per year is 4% of the current population, how long will it take for the population to double?
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2. Radium-226 decays at a rate proportional to the quantity present. Its half-life is 1612 years. How long will it take for one quarter of a given quantity of radium-226 to decay? (Hint: Let Q be the amount present at any time t . Let Q_0 be the quantity at $t = 0$. Then use the differential equation $\frac{dQ}{dt} = kQ$ and go from there as normal.)
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3. The curve $x^3 + x \tan y = 27$ passes through $(3,0)$. Use local linearization to estimate the value of y at $x = 3.1$. The value is A) -2.7 B) -0.9 C) 0 D) 0.1 E) 3.0
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4. At what value of h is the rate of increase of \sqrt{h} twice the rate of increase of h ?
A) $\frac{1}{16}$ B) $\frac{1}{4}$ C) 1 D) 2 E) 4
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5. A function $f(x)$ equals $\frac{x^2 - x}{x - 1}$ for all x except $x = 1$. In order that the function be continuous at $x = 1$, the value of $f(1)$ must be: A) 0 B) 1 C) 2 D) **p** E) none
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6. The number of inflection points of $f(x) = 3x^5 - 10x^3$ is: A) 4 B) 3 C) 2 D) 1 E) 0
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7. Suppose $f(x) = \int_0^x \frac{4+t}{t^2+4} dt$. It follows that:
A) f increases for all x B) f increases only if $x < -4$ C) f has a local min at $x = -4$
D) f has a local max at $x = -4$ E) f has no critical points
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8. (Free Response) Let $f(x) = x^3 + 3x^2 - x$.
- (a) The tangent to the graph of f at the point $P = (-2,6)$ intersects the graph of f again at the point Q . Find the coordinates of the point Q .
- (b) Find the coordinates of point R , the inflection point on the graph of f .
- (c) Show that the segment QR divides the region between the graph of f and its tangent at P into two regions whose areas are in the ratio of $\frac{16}{11}$.
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