

MATH 106 CALCULUS I FOR BIO. & SOC. SCI. FALL 2012

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Homework 2.

Please show all your work.

- (1) A certain strain of bacteria that reproduces asexually triples its size every 45 days. If after 180 days there are 1620 bacteria, how many bacteria were there originally?
- (2) A picture supposedly painted by Vermeer (1632-1675) contains 99.5% of its carbon-14. It is known that carbon-14 has a half life of 5730 years. From this information, can you decide whether or not the picture is a fake? Please explain your answer.

Hint: Let's call X_0 the initial amount of Carbon-14 in the painting. We don't know what X_0 is but that does not matter at the end. Use the given information to determine how old the picture is and conclude if the picture is fake or not.

- (3) Determine the values of the sequence $\{a_n\}$ for $n = 0, 1, 2, 3, 4$ in the following sequences

(a)

$$a_n = e^{\cos(\pi n)}.$$

(b)

$$a_n = \frac{n^2}{n+1}.$$

(c)

$$a_n = \sqrt{n+4}.$$

(d)

$$a_n = \sin\left(\frac{\pi n}{2}\right).$$

(e) The recursively defined sequence with $a_0 = 128$ and $a_{n+1} = \sqrt{a_n}$.

- (4) Determine if the following sequences converge or diverge. In case they converge find their limit.

(a)

$$a_n = \sin(\pi n).$$

(b)

$$b_n = \sin(2\pi n).$$

(c)

$$c_n = e^{-2n}.$$

(d)

$$d_n = \frac{n+1}{n^2}.$$

(e)

$$e_n = \frac{n^2 + 1}{n}.$$