Name: *Key*

Quiz 2 (20 points)

You must show all of your work!

1. Indiana Jones is spelunking for treasure in an abandoned studio when he finds an audio cassette with the recordings of Mike Jones on it. He wants to figure out how old the cassette is. On a previous adventure, he found a similar cassette of Norah Jones songs, which he knows is from the year 2008. Conveniently, the magnetic strip that holds the information in cassettes was made out of a radioactive isotope of Jonesium. The Norah Jones cassette has 85% of its radioactive Jonesium remaining (in the year 2011). [10 pts]

a) Using the data from the Norah Jones cassette, compute the continuous decay rate of Jonesium. (4 pts.) 85% after 3 yrs

$$.85 = e^{k3}$$

$$\ln(.85) = 3k$$

$$k = \frac{\ln(.85)}{3} = \boxed{-.0542}$$ or 5.4% cont. decay rate

b) Determine the half-life of Jonesium. (4 pts)

$$.5 = e^{-.542t}$$

$$\ln(.5) = -.0542t$$

$$t = \frac{\ln(.5)}{-.0542} \approx \boxed{12.795 \text{ yrs}}$$

c) Assuming that the Mike Jones cassette has 65% of its radioactive Jonesium remaining, determine the age of the cassette. (2 pts)

$$.65 = e^{-.0542t}$$

$$\ln(.65) = -.0542t$$

$$t = \frac{\ln(.65)}{-.0542} = \boxed{7.952 \text{ yrs}}$$

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4. The Awkward Turtle is riding a mini ferris wheel! The wheel has radius 1.5 meters but is lifted off the ground, so that even when he is at the lowest point of the ride, the Awkward Turtle is still 0.5 meters above the ground, which is, needless to say, distinctly awkward. The wheel turns at a constant rate of 1 revolution every 90 seconds.

Suppose that precisely at noon, the Awkward Turtle is 2 meters above the ground and moving toward the ground. Let $H(t)$ denote the height (in meters) of the Awkward Turtle above the ground, t minutes after noon.

(a) (3 points) ~~What is the sign of $H'(0)$? Explain.~~ Compute the Amplitude, Period, & Midline of $H(t)$. Include Units.

$$A = \frac{3.5 - .5}{2} = 1.5m \; ; \quad M = \frac{3.5 + .5}{2} = 2m \; ; \quad Pe = 1.5 m2$$
$$(1 \ 90sec)$$

(b) (3 points) Sketch, on the axes below, the function $H(t)$. Make sure you label the tick-marks!
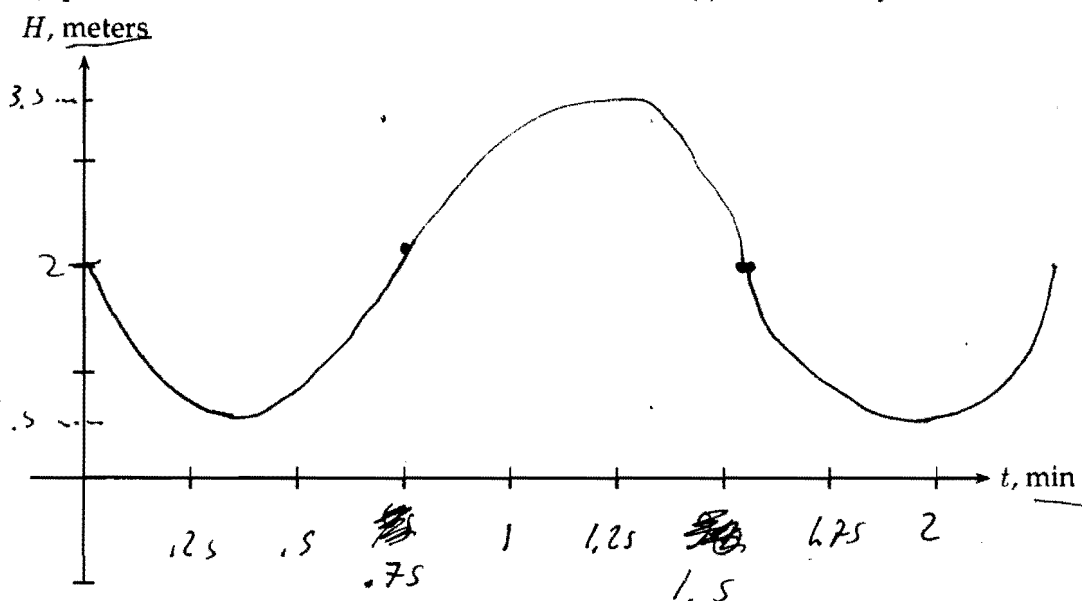
(c) (4 points) Determine a formula for the function $H(t)$.

$$H(t) = -1.5 \cos\left(\frac{2\pi}{1.5} t\right) + 2$$