Assignment #10

2/28/2001

18.3

#2 series diverges

$$\frac{1}{1000} + \frac{2}{1000} + \frac{3}{1000} + \frac{4}{1000} + \cdots$$

$$= \frac{1+2+3+4+5\cdots}{1000} = \frac{\infty}{1000} = \infty$$

numerator diverges; $\lim_{n\to\infty} a_n \neq 0$ (for numerator)

#6 $\frac{3^3}{3} + \frac{4^4}{4} + \frac{5^5}{5} + \cdots$

$= 3^2 + 4^3 + 5^4 + 6^5 + \cdots$

$\lim_{n\to\infty} a_n \neq 0$, so diverges

sum will just get bigger and bigger

18.5

#19 a) maximum level of salicylic acid occurs right after taking a pill

Amount of Drug left from a given pill $= (2A)\left(\frac{1}{2}\right)^{\frac{t}{3}}$

t in hours; amount taken

A = aspirin per pill

Amt of Drug $= 2A + 2A\left(\frac{1}{2}\right)^{\frac{3}{3}} + 2A\left(\frac{1}{2}\right)^{\frac{6}{3}} + 2A\left(\frac{1}{2}\right)^{\frac{9}{3}} + \cdots$ (infinite)

$$D = \frac{a}{1-r} = \frac{2A}{1-\frac{1}{2}} = \boxed{4A.}$$

It will reach 4-pill strength immediately after taking a pill, as

b) Amt of Drug $= 2A + 2A\left(\frac{1}{2}\right)^{\frac{2}{3}} + 2A\left(\frac{1}{2}\right)^{4/3} + 2A\left(\frac{1}{2}\right)^{\frac{6}{3}} + \ldots$

infinite geometric series

$r = \left(\frac{1}{2}\right)^{2/3}$

$\frac{a}{1-r} = \frac{2A}{1-\left(\frac{1}{2}\right)^{2/3}} = 5.4\,A$ (5.4 pills, maximum)

#26 R = amt of radioactive material

a) we know $\frac{dR}{dt} = -0.2R$

$R = R_0 e^{-0.2t}$ t in months; $R_0 = 40$ grams

$R = (40)e^{-0.2t}$

b) After 60th dump,

$R_0 + R_0 e^{-0.2(1)} + R_0 e^{(-0.2)(2)} + \ldots + R_0 e^{(-0.2)(59)}$

with $R_0 = 40$ g

$= 40 + 40e^{-0.2} + 40e^{(-0.2)(2)} + \ldots + 40e^{(-0.2)(59)}$

$S = \frac{40 - 40e^{(-0.2)(60)}}{1 - e^{-0.2}}$ $r = e^{-0.2}$

$\approx$ 221 grams

c) $\frac{a}{1-r} = \frac{R_0}{1-e^{-0.2}} = \frac{40}{1-e^{-0.2}} =$ 221 grams