Pre-Calculus 12 Word Problem Final Exam Review

1. Charlie company is a colony of 33 bacteria living in a remote nose pore on Pimple Perry's face. After 2 days of intense gaming and a steady diet of corn chips, Pepsi, and Twinkies, Perry's pore contains 14! bacteria. Determine the doubling time of the bacteria in minutes.

2. Alexander Litvinenko was murdered by being poisoned with polonium-210. (Not a great way to go.) The half-life of polonium-210 is 138.4 days. How long will it take for 3 gram sample to reach a mass of 0.2 grams?

3. Big Slick invests $ 1000.00 into a GIC that yields 2.5% /annum, compounded quarterly. How long will it take for his investment to reach $ 2500.00?

4. Jiminy Glick invests $ 321.23 into SCTV mutual funds. After 15 years, his investment is worth $ 54323.45. If the fund is compounded monthly, determine the yearly interest rate. (SCTV mutual funds are very difficult to come by.)

5. A recent survey shows that an average man's weight will increase by 2% per year and his IQ will decrease by 7% per year after the age of 20. Chess legend Gary Kasparov weighed 160 lbs at age 20 and had an IQ of 190. How old will he be when his weight in lbs will equal his IQ score?

6. Jenny is building a box to hide inside to avoid doing her exam. She is using a rectangular piece of cardboard that is 80 inches by 60 inches. She cuts a square from each corner of the cardboard and then folds the corners up to create the box. The resulting volume of the box is 19 584 cubic inches. Determine the length of the square she cut from each corner of the box.
ADVANCED: Do you think it would be possible for Jenny to hide side this box to avoid the exam. Please write your answer in form of a sonnet using iambic pentameter.

7. Capsules Inc. is the largest manufacturer of Balaenoptera antidepressants. Due to their endangered species status, many of the world's Balaenoptera are quite blue. Capsules Inc. makes a Balaenoptera pill that is a capsule the shape of a right circular cylinder with hemisphere on each end. The total length of the capsule is 32 inches and has a volume of $1008\pi\ in^3$. Determine the radius of the capsule.

8. In a group of 30 students, there are 7 smart students, 18 averagely smart students, and rest are really.... and I mean, really... stewpeed students.
   a. How many ways can the stewpeed students be arranged around a round table?
   b. How many groups of 5 students can be formed that have....
      i. no stewpeed students?
      ii. exactly 2 smart students and 2 stewpeed students?
      iii. at most 4 stewpeed students?

Word Problem Final Exam Review Solutions

1. $A = A_0(x)^{\frac{t}{T}}$

$14! = 33(2)^{\frac{2}{T}}$

$\frac{14!}{33} = 2^{\frac{2}{T}}$

$\log_2\left(\frac{14!}{33}\right) = \frac{2}{T}$

$T = \frac{2}{\log_2\left(\frac{14!}{33}\right)} = \frac{2}{\left(\frac{\log\left(\frac{14!}{33}\right)}{\log 2}\right)} = 0.0639 \text{ days}$

$$\frac{0.0639 \text{ days}}{1} \left| \frac{24 \text{ h}}{1 \text{ day}} \right| \frac{60 \text{ min}}{1 \text{ h}} = \boxed{92 \text{ minutes}}$$

2. $A = A_0(x)^{\frac{t}{T}}$

$0.2 = 3(0.5)^{\frac{t}{138.4}}$

$\frac{1}{15} = (0.5)^{\frac{t}{138.4}}$

$\frac{t}{138.4} = \log_{0.5}\left(\frac{1}{15}\right)$

$t = 138.4 \frac{\log\left(\frac{1}{15}\right)}{\log(0.5)}$

$= \boxed{541 \text{ days}}$

3. $A = P\left(1 + \frac{r}{n}\right)^{nt}$

$2500 = 1000\left(1 + \frac{0.025}{4}\right)^{4t}$

$2.5 = \left(1 + \frac{0.025}{4}\right)^{4t}$

$4t = \log_{\left(1 + \frac{0.025}{4}\right)}(2.5)$

$t = \dfrac{\log(2.5)}{4\log\left(1 + \frac{0.025}{4}\right)}$

$t = \boxed{\sim 36.8 \text{ years.}}$

4. $A = P\left(1 + \frac{r}{n}\right)^{nt}$

$54323.45 = 321.23\left(1 + \frac{r}{12}\right)^{(12)(15)}$

$169.1108 = \left(1 + \frac{r}{12}\right)^{180}$

$\sqrt[180]{169.1108} = 1 + \frac{r}{12}$

$1.02891 = 1 + \frac{r}{12}$

$0.02891 = \frac{r}{12}$

$r = 0.3469$

$r = \boxed{34.7\%}$

5. $A = A_0(x)^{\frac{t}{T}}$

$160(1.02)^{\frac{t}{1}} = 190(0.93)^{\frac{t}{1}}$

$(1.02)^t = 1.1875\,(0.93)^t$

$t \log 1.02 = \log 1.1875 + t \log(0.93)$

$t \log 1.02 - t \log(0.93) = \log 1.1875$

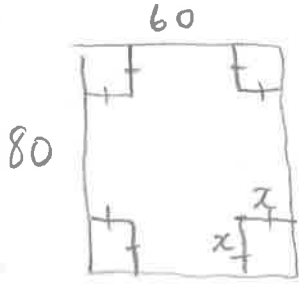
$t(\log 1.02 - \log 0.93) = \log 1.1875$

$$t = \frac{\log 1.1875}{(\log 1.02 - \log 0.93)}$$

$t = 1.86$ yrs.

He'll be | 21.86 yrs old |

6.



$V = lwh$

$19584 = (80-2x)(60-2x)(x)$

$19584 = 4x^3 - 280x^2 + 4800x$

$4x^3 - 280x^2 + 4800x - 19584 = 0$

$x^3 - 70x^2 + 1200x - 4896 = 0$

6	1	-70	1200	-4896
		6	-384	4890
	1	-64	816	0

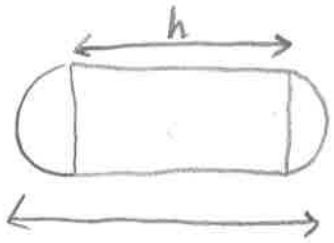
$(x-6)(x^2 - 64x + 816) = 0$

$x = 6$ in

$x = \frac{64 \pm \sqrt{(-64)^2 - 4(1)(816)}}{2} = \frac{64 \pm \sqrt{832}}{2} = 48.4,\ 17.6$ in.

TWO POSSIBLE BOXES

7.



$V = \pi r^2 h + \frac{4}{3}\pi r^3$

$1008\pi = \pi r^2(32-2r) + \frac{4}{3}\pi r^3$

$h = 32 - 2r$

$1008 = 32r^2 - 2r^3 + \frac{4}{3}r^3$

6

1	−48	0	1512
	6	−252	−1512
1	−42	−252	0

$\frac{4}{3}r^3 - 2r^3 + 32r^2 - 1008 = 0$

$\frac{-2}{3}r^3 + 32r^2 - 1008 = 0$

$\frac{2}{3}r^3 - 32r^2 + 1008 = 0$

$r^3 - 48r^2 + 1512 = 0$

$(r-6)(r^2 - 42r - 252) = 0$

$r = \frac{42 \pm \sqrt{(-42)^2 - 4(1)(-252)}}{2} = \frac{42 \pm \sqrt{2772}}{2}$

$= 47.3, -5.3$

$r = 6$ in.

8. a) $4! = 24$

b) i) ${}_{25}C_5 = 53130$

ii) ${}_7C_2 \cdot {}_5C_2 \cdot {}_{18}C_1 = 21 \cdot 10 \cdot 18 = 3780$

iii) ${}_{25}C_1 \cdot {}_5C_4 + {}_{25}C_2 \cdot {}_5C_3 + {}_{25}C_3 \cdot {}_5C_2 + {}_{25}C_4 \cdot {}_5C_1 + {}_{25}C_5 = 25 \cdot 5 + 300 \cdot 10 + 2300 \cdot 10 + 12650 \cdot 5 + 53130 = 142505$