SOLUTIONS

Practice Exam 3A

Relax. You have done problems like these before. Even if these problems look a bit different, just do what you can. If you're not sure of something, please ask! You may use your calculator. Please show all of your work and write down as many steps as you can. Don't spend too much time on any one problem. Do well. And remember, ask me if you're not sure about something.

Over 50 points on this exam are for solving equations and inequalities. Be sure you understand what you need to show for full credit. Using a different method will get little to no partial credit.

As you work, make a "don't forget" list of any information you need to look up or ask about.

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1. The Skärstroms want to dig a new well for water for their lake cabin. The company charges $900 to bring the equipment on site and draw the permit and then $2 per foot to dig. That means

$$W = 900 + 2F$$

where F is the depth of the well (in feet) and W is the cost of the well (in $).

   (a) In their neck of the woods, wells often run 200 feet deep. According to the equation, how much would that cost?

   $$W = 900 + 2 \times 200 = \boxed{\$1,300}$$

   (b) The Skärstroms have budgeted between $1,500 and $1,800 for the well. Set up and solve a chain of inequalities to find the corresponding range of depths.

   Be sure to use ≤

   $$1500 \leq 900 + 2F \leq 1800$$
   $$-900 \qquad -900 \qquad -900$$
   $$600 \leq 2F \leq 900$$
   $$\frac{600}{2} \leq \frac{2F}{2} \leq \frac{900}{2}$$
   $$300 \leq F \leq 450$$

   For their budget, they can dig a well 300 to 450 feet deep.

   (c) No such luck. The company had to drill much deeper than hoped to find water. The final result, wonderfully cold and clear drinking water. And, a hefty bill for $2,072. How deep is their well? Set up and solve an equation.

   $$900 + 2F = 2,072$$
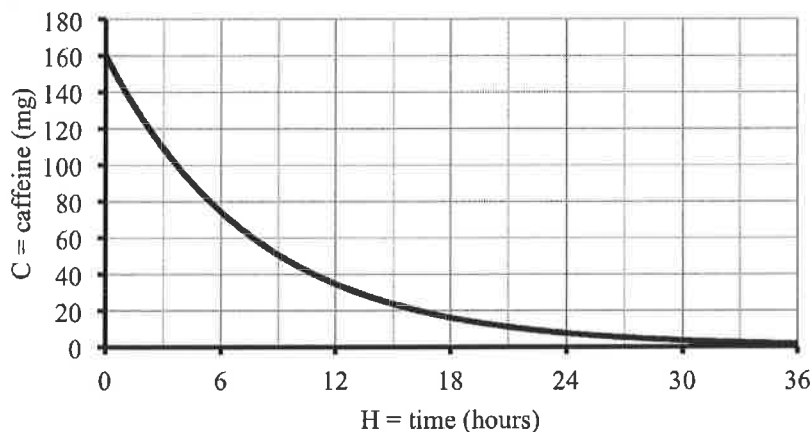 $$-900 \qquad -900$$
   $$\frac{2F}{2} = \frac{1,172}{2}$$
   $$F = \boxed{586 \text{ feet deep}}$$

2. Ceyda starts the day by downing two cans of Red Bull, containing a total of 160 mg of caffeine. Her body eliminates the caffeine at a rate of 12% each hour. That means the amount of caffeine (C mg) after H hours is given by the equation graphed below

$$C = 160 * .88^H$$

(a) According to the equation, how much caffeine is in her body initially, after 2 hours, 5 hours, and 24 hours? Display your answers in table.

[handwritten: $160 \times .88 \wedge \underline{24} =$]

H	0	2	5	24
C	160	123.9	84.4	7.44

(b) Show show to use successive approximation to find when there will Ceyda's caffeine level first drops below 20 mg. Answer to the nearest hour.

[handwritten box: ≈ 17 hours]

H	5	24	15	20	17	16
C	84.4	7.44	23.5	12.4	18.2	20.69 ← not "below" 20
	VS 20	HIGH	LOW	HIGH	LOW	LOW HIGH

(c) Set up and solve an equation to determine when Ceyda's caffeine level first drops below 20 mg. Round your answer to two decimal places.

[handwritten note: notice: variable is the exponent & % decrease each ⇒ exponential equation]

$$\frac{160 * .88^H}{160} = \frac{20}{160} \qquad \{ 20 \div 160 =$$

$$.88^H = .125$$

[handwritten: By the Log Divides Formula] $v = .125$, $g = .88$

$$H = \frac{\log(.125)}{\log(.88)} = \log(.125) \div \log(.88) = 16.266.$$

[handwritten box: ≈ 16.27 hours]

[handwritten note: note: they asked for 2 decimal places.]

3. Jorge deposited $1,500 in an high yield money market account and plans to leave it there for 5 years. The value of his account after 5 years $A will depend on the growth factor g as given by the equation
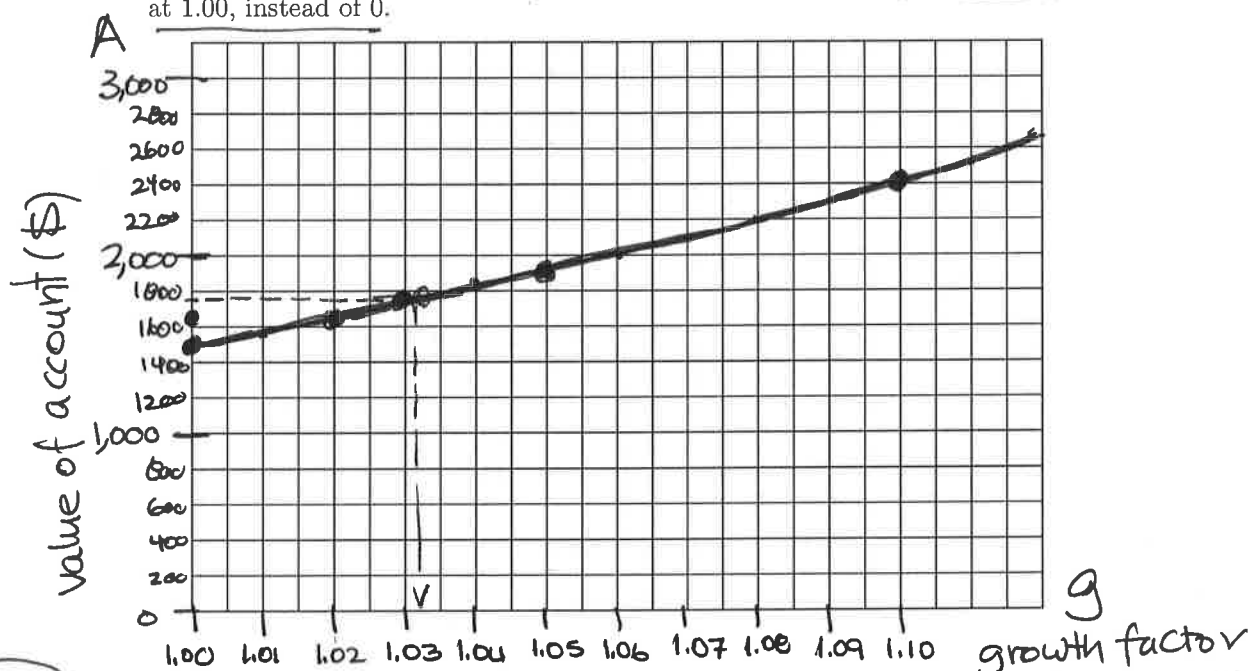
$$A = 1,500g^5$$

(a) Use the equation to complete the table.

[handwritten: 1500 × 1.03 ^ 5 =]

g	1.02	1.03	1.05	1.10
A	1,656.12	1,738.91	1,914.42	2,415.77

[handwritten: 1500 × 1.00 ^ 5 = 1500]

(b) Draw a graph showing how A depends on the growth factor g. Start the g-axis at 1.00, instead of 0.

(c) Use your graph to estimate the growth factor if the value of Jorge's account after 5 years is $1,780.

[handwritten: Just slightly more than 1.03] *[handwritten: see also table]*

[handwritten left margin: notice: variable g is raised to power ⇒ power equation]

(d) Now set up and solve an equation to find the answer.

[handwritten:
$$1500 \, g^5 = 1780$$
$$g^5 = 1.1866...$$
$$1780 \div 1500 =$$
By the root formula
$$g = \sqrt[5]{1.1866.....}$$
$$= 1.03482.....$$
$$\approx 1.0348$$
]

(e) What is the corresponding **return on investment**? That means calculate $r = g - 1$. The return on investment is r written as a percentage.

[handwritten:
$$r = g - 1 = 1.0348 - 1 = .0348 = 3.48\%$$
$$\times 100\%$$
]

[handwritten cloud: 5 ×√ ANS = or try 5 MATH 5 ANS =]

4. A rabbit jumps so that her height above ground is given by the formula

$$R = 17.6S - 22S^2$$

where R = height of rabbit (feet above ground) and S = time (seconds).

(a) At what height did the rabbit <u>start</u> her jump?

S=0 seconds

$\Rightarrow$ R= 17.6×0 − 22 × 0 x² = $\boxed{0 \text{ feet}}$ on the ground ☺

(b) Can the rabbit jump over a 3 foot fence? Calculate the exact maximum height of the rabbit to decide.

R= 17.6S − 22S² = −22S² +17.6S +0

a= −22, b=17.6, c=0

(cloud note) there wasn't any constant written so it must be +0

(cloud note) fact: max when S= −b/2a

S= $\frac{-17.6}{2(-22)}$ = (−)17.6 ÷ (2×(−)22) = .4 seconds

(note) don't forget parentheses

R= 17.6×.4 − 22×.4 x² = 3.52 feet ⇒ *(boxed)* Yes, rabbit can clear fence

(left cloud note) notice: equation has form H= aT² + bT + c ⇒ Quadratic

(c) How long does it take the rabbit to get 2 feet in the air and when is she at that height again? Set up and solve the appropriate equation to find the answers.

17.6S − 22S² = 2 ⇒ −22S² +17.6S −2 = 0
  −2   −2

a= −22, b=17.6, c= −2 ⟵ *(note)* NEW

(label) By the Quadratic Formula

S= $\frac{-17.6}{2(-22)}$ ± $\frac{\sqrt{17.6^2 - 4(-22)(-2)}}{2(-22)}$

(note) don't forget parentheses for under √

(−)17.6 ÷ (2×(−)22) =   √(17.6 x² − 4 × (−)22 × (−)2) ÷ (2×(−)22) =

= .4   ± ⁻.262851

S ⟨ .4 + ⁻.26 = .14 seconds
    .4 − ⁻.26 = .66 seconds

(boxed) The rabbit first reaches 2 feet in .14 seconds and she is again at that height at .66 seconds