

Name: Solutions!

Due Friday, October 10

Worksheet 2

1. Virgil Earp has about \$2000 saved up from his time serving in the 83rd Illinois Infantry. Right now it is in a strong box in his basement. He's decided to put it in a bank account instead.

- (a) Wells Fargo is offering 3% APR, compounded monthly. How much will he have in 25 years when he ends his career in law enforcement?

$$A = 2000 \cdot \left(1 + \frac{0.03}{12}\right)^{12 \cdot 25}$$
$$= \boxed{\$4230.03}$$

- (b) Virgil's brother Wyatt has only \$1000 saved up, but since he has occasionally worked security for Wells Fargo, he gets the employee rate of 5% compounded continuously. Which of them will have more money in 25 years?

$$A = \$1000 \cdot e^{0.05 \cdot 25} = \boxed{\$3490.34}$$

- (c) How much would Wyatt have to deposit now to have the same amount as his brother in 25 years?

$$\$4230.03 = P \cdot e^{0.05 \cdot 25}$$
$$\frac{\$4230}{e^{0.05 \cdot 25}} = P$$
$$P = \boxed{\$1211.92}$$

2. (a) Virgil just got a job as the town marshal of a small town in Arizona. He's been able to save up about \$50 per month from his salary. If he deposits it in a different Wells Fargo account, still at 3%, how much will he have in 10 years?

$$A = \$50 \times \frac{\left[\left(1 + \frac{0.03}{12}\right)^{12 \cdot 10} - 1\right]}{\left(\frac{0.03}{12}\right)}$$
$$= \boxed{\$6987.07}$$

- (b) Suppose he wants to have \$10,000 in ten years so he can open up a hotel in Goldfield, Nevada. How much should he deposit each month?

$$\$10,000 = \text{PMT} \times \frac{\left[\left(1 + \frac{0.03}{12}\right)^{12 \cdot 10} - 1 \right]}{\left(\frac{0.03}{12}\right)}$$

$$\text{So } P = \boxed{\$71.86}$$

$$\frac{\$10,000}{\left(\frac{\left[\left(1 + \frac{0.03}{12}\right)^{12 \cdot 10} - 1 \right]}{\left(\frac{0.03}{12}\right)} \right)} = P$$

3. Tragedy! Virgil and Wyatt's brother Morgan was helping Virgil in the pursuit of his duties, and was injured. Since he was only a temporary deputy, and times are tough, the town refuses to pay for his medical bills.

- (a) Going to a doctor in town will cost \$400. Morgan can't afford that, but the grateful town offers to loan him the money at an APR of 2%. Morgan would like to pay off his bills in 3 years. What should his monthly payments be?

$$\text{PMT} = \frac{\$400 \cdot \left(\frac{0.02}{12}\right)}{\left[1 - \left(1 + \frac{0.02}{12}\right)^{-12 \cdot 3} \right]}$$

$$= \boxed{\$11.46}$$

- (b) How much money will he have paid total? What percentage of that was the result of interest?

$$\text{Total paid: } \frac{12 \text{ mo}}{3 \text{ years}} \cdot \frac{\$11.46}{1 \text{ mo}} = \boxed{\$412.46}$$

Interest paid: ... of which $\$412.46 - \$400 = \$12.46$ was interest...

$$\text{Percentage: ... and so } \frac{\$12.46}{\$412.46} = 0.03019 = \boxed{3.019\%}$$

was interest.

- (c) Suppose instead he wishes to convalesce at a hospital near his parents' house in Colton, California. The treatment there will be more expensive. If he can afford payments of \$20 per month, and he'd like to have the loan paid off in 3 years, how large a loan can he afford to take out?

$$\$20 = \frac{P \times \left(\frac{0.02}{12}\right)}{\left[1 - \left(1 + \frac{0.02}{12}\right)^{-12 \cdot 3} \right]}$$

$$\frac{\$20}{\left(\frac{\left(\frac{0.02}{12}\right)}{\left[1 - \left(1 + \frac{0.02}{12}\right)^{-12 \cdot 3} \right]} \right)} = P$$

$$P = \$698.26$$