11 Math

Name: ______________________
Date: ______________________

Financial Application Questions

Indicate which formula to use, which variable to solve for, and then solve. Compare with your answers from the TVM solver.

$$I = Prt \qquad A = P + I \qquad \overset{A}{\cancel{FV}} = P(1+i)^n \qquad PV = \frac{A}{(1+i)^n} \qquad A = \frac{R[(1+i)^n - 1]}{i} \qquad PV = \frac{R[1-(1+i)^{-n}]}{i}$$

1. Jason invests $500 in an account that pays interest at a rate of 3.9 %/a, compounded monthly.
   a) How much will he have after 6 years?

   $A = P(1+i)^n \qquad i = 0.039 \div 12 = 0.00325$

   $= 500(1.00325)^{72}$

   $= \$631.58$

   ∴ He will have $631.58 after 6 years.

   b) How long will it take him to have $1 200?

   $FV = P(1+i)^n$

   $1200 = 500(1.00325)^n$

   $2.4 = 1.00325^n$

   $n = \frac{\log 2.4}{\log 1.00325} \doteq 270$ months

   $\doteq 22.5$ years.

2. Jolanda wants to save enough money to buy a $900 wedding dress in 2 years.
   a) If her account pays interest at a rate of 2.1% / a, compounded weekly, how much must she deposit now?

   $i = \frac{0.021}{52} = 0.0004038$

   $n = 104$

   $PV = A(1+i)^{-n}$

   $= 900(1.0004038)^{-104}$

   $= \$862.99$

   b) What must her interest rate be if she has $820 today?

   $FV = P(1+i)^n$

   $900 = 820(1+i)^{104}$

   $1.09756 = (1+i)^{104}$

   $\sqrt[104]{1.09756} = 1+i$

   $i = 0.0008955$ per week ×52

   $= 0.0466$ ∴ 4.66% / year.

3. John deposits $300 every 3 months into an account that pays interest at a rate of 3.3%/a, compounded quarterly.
   a) How much will he have after 5 years?

   $A = R\left[\frac{(1+i)^n - 1}{i}\right]$

   $= 300\left[\frac{1.00825^{20} - 1}{0.00825}\right]$

   $= \$6494.37$

   ∴ He will have $6494.37 after 5 years.

   b) How long will it take him to have $11 000?

   $A = R\left[\frac{(1+i)^n - 1}{i}\right]$

   $11000 = 300\left[\frac{1.00825^n - 1}{0.00825}\right]$

   $\frac{90.75}{300} = \frac{300}{300}[1.00825^n - 1]$

   $0.3025 = 1.00825^n - 1$

   $1.3025 = 1.00825^n$

   $n = \frac{\log 1.3025}{\ldots} \doteq 32$ quarters $\approx$ 8 years

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4. Jane wants to put a $25 000 down payment on a house 3 years from now.

a) If her account pays interest at a rate of 1.7% / a, compounded monthly, how much must she deposit every month?

$A = \frac{R[(1+i)^n - 1]}{i}$ $i = 0.017 \div 12 = 0.001417$

$n = 3 \times 12 = 36$

$25000 = \frac{R[(1.001417)^{36} - 1]}{0.001417}$

$25000 = R(36.907)$

$\boxed{R = \$677.38}$

b) What must her interest rate be if she can afford monthly payments of $600?

$A = \frac{R[(1+i)^n - 1]}{i}$

$25000 i = 600[(1+i)^{36} - 1]$

$0 = 600(1+i)^{36} - 600 - 25000i$

Use TVM Solver :)

5. Jackie is planning to retire with $500 000 in her account that pays an interest rate of 4.5%/a, compounded semi-annually.

a) If she wants semi-annual payments for 30 years, how much will she receive every 6 months?

$PV = \frac{R[1-(1+i)^{-n}]}{i}$ $i = \frac{0.045}{2} = 0.0225$

$n = 30 \times 2 = 60$

$500\,000 = \frac{R[1-(1.0225)^{-60}]}{0.0225}$

$500\,000 = R(32.7490)$

$\boxed{R = 15267.66}$

b) If she wants semi-annual payments of $18 000, how long will she receive payments?

$PV = \frac{R[1-(1+i)^{-n}]}{i}$

$500000 = \frac{18000[1-(1.0225)^{-n}]}{0.0225}$

$\frac{11250}{18000} = 1 - 1.0225^{-n}$

$1.0225^{-n} = 1 - 0.625$

$\frac{1}{1.0225^n} = 0.375$

$1.0225^n = 2.6667$

$n \log 1.0225 = \log 2.6667$

$n = 44.1$ 6 month

$\boxed{= 22.1 \text{ years}}$

6. Jorge bought a racing bicycle for $3 500 and agreed to pay the store back with weekly payments. The store charges him interest at a rate of 11%/a, compounded weekly.

a) If he wants to pay back the store by the end of 2 years, how much must he pay every week?

$PV = \frac{R[1-(1+i)^{-n}]}{i}$ $i = 0.11 \div 52 = 0.002115$

$n = 2 \times 52 = 104$

$3500 = \frac{R[1-(1.002115)^{-104}]}{0.002115}$

$3500 = R(93.2666)$

$\boxed{R = \$37.53}$

b) If he can only pay $20 a week, how long will it take him to pay off his purchase?

$PV = \frac{R[1-(1+i)^{-n}]}{i}$

$3500 = \frac{20[1-(1.002115)^{-n}]}{0.002115}$

$\frac{7.4}{20} = 1 - (1.002115)^{-n}$

$1.002115^{-n} = 1 - 0.37$

$1.002115^n = \frac{1}{0.6298}$

$n \log 1.002115 = \log 1.58779$

$n = 218.8$ weeks

$= \boxed{4.2 \text{ years}}$

7. Edna deposited $6 000 in an account that paid simple interest at 7.5% /a.

a) If she made no further deposits, how much would she have had in her account after 50 years?

$I_1 = Prt$

$= 6000(0.075)(50)$

$= 22500$

$A = P + I = 6000 + 22500 = \boxed{\$28500}$

b) If the balance is now $36 150, how long has Edna had her money in this account (assuming no further deposits)?

$A = P + I$

$I = 36150 - 6000$

$= 30150$

$I = Prt$

$30150 = 6000(.075)t$

$t = \frac{30150}{(6000)(.075)} = \boxed{67 \text{ yrs}}$

c) Assume Edna's account paid compound interest instead, compounded annually. How much additional interest would she have accrued after 50 years?

$A = P(1+i)^n$

$= 6000(1.075)^{50}$

$= 223\,138.48$

$A = P + I_1$ so $I_2 = 223\,138.48 - 6000$

Difference $= I_2 - I_1$

$= 217\,138.48 - 22500$

$\boxed{\text{Difference} = \$194\,638.48}$