Abe Mirza **Finance**

$$F = P(1+\frac{r}{n})^{nt}$$

$F =$ Future Value $P =$ Present Value $t =$ time in years

$r =$ rate $n =$ Compounding periods((how often the interest is added to the principle)

Ex 1. If $4000.00 is invested at an interest rate of 6% for 10 years at different compounding periods, then find the **future value** and total interest for each case.

Compounding Period	**Future Value**	**Total Interest** $I = F - P$
Annually **n = 1** **r =7%** **r = 8%**	$F = 4000(1+\frac{0.06}{1})^{1(10)} = 7163.39$ $F = 4000(1+\frac{0.07}{1})^{1(10)} = 7868.61$ $F = 4000(1+\frac{0.08}{1})^{1(10)} = 8635.70$	$I = 7163.39 - 4000 = 3163.39$ $I = 7868.61 - 4000 = 3868.61$ **By 1% higher rate, gain of $705.22** $I = 8635.70 - 4000 = 4635.70$ **By 2% higher rate, gain of $1472.31**
Semiannually **n =** 2	$F = 4000(1+\frac{0.06}{2})^{2(10)} = 7224.44$	$I = 7224.44 - 4000 = 3224.44$
Quarterly **n =** 4	$F = 4000(1+\frac{0.06}{4})^{4(10)} = 7256.07$	$I = 7256.07 - 4000 = 3256.07$
Monthly **n =** 12	$F = 4000(1+\frac{0.06}{12})^{12(10)} = 7277.59$	$I = 7277.59 - 4000 = 3277.59$
Daily **n =** 365	$F = 4000(1+\frac{0.06}{365})^{365(10)} = 7288.12$	$I = 7288.12 - 4000 = 3288.12$

Practice Problems

$$F = P(1+\frac{r}{n})^{nt}$$

$F =$ Future Value $P =$ Present Value $t =$ time in years

$r =$ rate $n =$ Compounding periods((how often the interest is added to the principle)

A: If $1000.00 is invested at an interest rate of 9% for 15 years at different compounding periods, find the **future value** and effective interest rare for each case.

Compounding Period	**Future Value**	**Total Interest** $I = F - P$
Annually **n = 1**	**Answer:$3642.48**	**Answer:$2642.48**
Semiannually **n =** 2	**Answer:$3745.32**	**Answer:$2745.32**
Quarterly **n =** 4	**Answer:$3800.13**	**Answer:$2800.13**
Monthly **n =** 12	**Answer:$3838.04**	**Answer:$2838.04**
Daily **n =** 365	**Answer:$3856.78**	**Answer:$2856.78**

Present Value

Ex 2: A company has agreed to pay $2.4 million in 5 years to settle a law suit. How much must they invest now in an account paying 8% with compounding periods to have that amount when it is due?

$$F = P(1+\frac{r}{n})^{nt}$$

Compounding Period	**Present Value**
Annually **n = 1**	$2.4 = P(1+\frac{.08}{1})^{1(5)}$ $\quad 2.4 = P(1.08)^5$ $2.4 = P(1.4693)$ $\quad P = 2.4/1.4693 = 1.6334$ **million**
Semiannually **n** = 2	*Ans* :$ 1.6214 **million**
Quarterly **n** = 4	*Ans* :$ 1.61513 **million**
Monthly **n** = 12	*Ans* :$ 1.6109 **million**
Daily **n** =	*Ans* :$ 1.6088 **million**

Practice Problems

A company has agreed to pay $4.5 million in 10 years to settle a law suit. How much must they invest now in an account paying 9 % with compounding periods to have that amount when it is due?

Compounding Period	Present Value
Annually **n =**	*Ans* :$ 1.901 **million**
Semiannually **n =**	*Ans* :$ 1.8659 **million**
Quarterly **n =**	*Ans* :$ 1.8479 **million**
Monthly **n =**	*Ans* :$ 1.8356 **million**
Daily **n =**	*Ans* :$ 1.8298 **million**

Solving for t(time) and r(rate) by trials and error.

C: How long will $25,000 investment need to results to a future value of $40,000? The interest rate is 6% compounded monthly.

$40,000 = 25,000(1+\frac{.06}{12})^{12t}$ $\quad 40,000/25000 = (1.005)^{12t}$ $\quad 1.6 = (1.005)^{12t}$

Then try to pick different t values that make the equation $1.6 = (1.005)^{12t}$ work

D: How long will $50,000 investment need to result a future value of $88,000? The interest rate is 8% compounded semi annually.

E: How long will $180,000 investment take to results to a future value of $230,000? The interest rate is 4.5% compounded monthly.

F: At what interest rate will $20,000 investment need to result a future value of $45,000 if the money is kept in 20 years? Assuming it is compounded semi annually.

G: At what interest rate will $25,000 investment need to result a future value of $45,000 if the money is kept in 10 years? Assuming it is compounded monthly.

Compound Interest Worksheets

*Name*_____

Calculate the total amount of the investment or total paid in a loan in the following situations:

1.) Your 3 year investment of $20,000 received 5.2% interested compounded semi annually. What is your total return?

Answer: $23,329.97

2.) You borrowed $59,000 for 2 years at 11% which was compounded annually. What total will you pay back?

Answer: $72,693.90

3.) Your allowance of $190 got 11% compounded monthly for 1 2/3 years. What's it worth after the 1 2/3 years?

Answer: $228.04

4.) Your 6 1/4 year investment of $40,000 at 14% compounded quarterly is worth how much now?

Answer: $94,529.80

5.) You borrowed $1,690 for 5 1/2 years a at 5.7% compounded semi annually. What total will you pay back?

Answer: $2,176.33

6.) Your $440 gets 5.8% compounded annually for 8 years. What will your $440. be worth in 8 years?

Answer: $690.78

7.) Your $54,200 2 year car loan is at 15.1% compounded annually. What will you have paid for your car after 2 years?

Answer: $71,804.21

8.) You invest $55 at 10% compounded annually for 3 years. How much will your investment be worth in 3 years?

Answer: $73.21

9.) Your 8 year loan of $12,200 is at 5.3% compounded annually. How much will you have paid in total for your loan?

Answer: $18,441.10

10.) You invest $1,900 at 4% and it's compounded semi annually for 3 years. How much will your $1,900 be worth in 3 years?

Answer: $2,139.71

Applications of compound interest

Date; _____ Section; _____ NAME _____

Solve each problem. Show all work.

1. How much money will you have in 6 years if you invest $5000 at 4 ½ % compounded monthly?

1)_____

2. What interest rate do you need for a $4000 investment to double in 12 years?

2)_____

3. How much money do you need to invest at 4 % in order to have $10,000 after 8 years?

3)_____

4. How much money will you have in 4 months if you invest $2000 at 4% compounded monthly?

4)_____

5. How much interest will you earn in 10 years if you invest $8500 at 4 ¼ % compounded semi-annually?

5)_____

6. In 1995, the population of Math Valley was 18,000. If the population is increasing at an annual rate of 2.5%, what was the population in 2015?

6)_____

7. A certain species of bird is in danger of becoming extinct. There were 1600 birds in 2000 and they are decreasing at an annual rate of 5.6%.

   a) If this trend continues, how many birds will be left by 2015? 7a)_____

   b) How many birds would there have been in 1995? 7b)_____

8. How much money would you need to deposit today at 5% annual interest compounded quarterly to have $16,000 in the account after 9 years?

   8)_____

9. How much money do you need to invest at 3.2% compounded daily in order to have $15,500 at the end of 10 years?

   9)_____

10. If you deposit $2500 into an account paying 11% annual interest compounded quarterly, how long until there is $4500 in the account?

    10)_____