

# MATH1003 Calculus and Linear Algebra Tutorial

## Week 01 — Worksheet: Mathematics of Finance

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1. (Demonstration, Simple Interest ) (p. 132, Q46) A loan of \$10,000 was repaid at the end of 6 months. What amount was repaid, if a 6.5% annual rate of interest was charged?

$$10000 \left( 1 + \frac{0.065}{2} \right) = 10325$$

2. (Demonstration, Simple Interest ) (p. 132, Q. 48) A check for \$3,097.50 was used to retire a 5-month \$3,000 loan. What annual rate of interest was charged?

$$3000 \left( 1 + \frac{5}{12} r \right) = 3097.5 \quad r = 7.8\%$$

3. (Demonstration, Simple Interest ) (p. 132, Q. 58 ) To complete the sale of a house, the seller accretes a 180-day note for \$10,000 at 7% simple interest. (Both interests and principal are repaid at the end of 180 days.) Wishing to use the money sooner for the purchase of another house, the seller sells the note to a third party for \$10,124 after 60 days. What annual interest rate will the third party receive for the investment?

$$10000 \left( 1 + \frac{180}{360} \cdot 0.07 \right) = 10124 \left( 1 + \frac{120}{360} r \right)$$

$$r = 0.067 = 6.7\%$$

4. (Demonstration, Compound Interest) (p. 142, Q.28 (A) ) If \$20,000 is invested at 4% interest compounded monthly, what is the amount after 5 years?

$$20000 \cdot \left( 1 + \frac{0.04}{12} \right)^{12 \times 5} = 24419.93$$

5. (Demonstration, Compound Interest) (p.143 , Q.36 (A) ) If an investment company pays 8% compounded quarterly, how much should you deposit now to have \$6,000 3 years from now?

$$6000 = P \left( 1 + \frac{0.08}{4} \right)^{3 \times 4} \quad P = 4730.96$$

6. (Demonstration, Annual Percentage Yield) (p.144 , Q. 62 ) Which is the better investment scheme: 8% compounded quarterly or 8.3% compounded annually?

$$\left( 1 + \frac{0.08}{4} \right)^4 - (1 + 0.083)$$

$$= -0.000568 < 0$$

8.3% compounded annually is better

7. (Demonstration, Zero Coupon Bond) (p. 145, Q. 84) A zero coupon bond with a face value of \$20,000 matures in 10 years. What should the bond be sold for now if its rate of return is to be 4.194% compounded annually?

$$P \left( 1 + \frac{0.04194}{1} \right)^{10} = 20000$$

$$P = 13261.813$$

8. (Demonstration, Annuity) (p. 152, Q. 22) USG Annuity and Life offered an annuity that pays 7.25% compounded monthly. If \$1,000 is deposited into this annuity every month, how much is in the account after 15 years? How much of this is the interest?

$$1000 \frac{\left( 1 + \frac{0.0725}{12} \right)^{12 \times 15} - 1}{\frac{0.0725}{12}} = 323943.072$$

$$323943.072 - 1000 \times 12 \times 15 = 143943.072$$

9. (Exercise, Compound Interest) (p. 142, Q.28 (B)) If \$20,000 is invested at 4% interest compounded monthly, what is the amount after 8 years?

$$20000 \left( 1 + \frac{0.04}{12} \right)^{8 \times 12} = 27527.902$$

10. (Exercise, Compound Interest) (p.143, Q.36 (B)) If an investment company pays 8% compounded quarterly, how much should you deposit now to have \$6,000 6 years from now?

$$P \left( 1 + \frac{0.08}{4} \right)^{4 \times 6} = 6000 \quad P = 3730.329$$

11. (Exercise, Zero Coupon Bond) (p. 145, Q. 86) If you pay \$32,000 for a 5-year zero coupon bond with a face value of \$40,000. What is your annual compound rate of return?

$$32000 (1+r)^5 = 40000 \quad r = 4.56\%$$

12. (Exercise, Sinking Fund) (p. 152, Q. 28) Parents have set up a sinking fund in order to have \$120,000 in 15 years for their children's college education. How much should be paid semiannually into an account paying 6.8% compounded semiannually?

$$A = 120000 \cdot \frac{\frac{0.068}{2}}{\left( 1 + \frac{0.068}{2} \right)^{30} - 1}$$

$$A = 2363.0709$$