



Quantitative Methods Preparation Session
Self-Assessment Test
2013

1. Suppose the population of B.C. is growing at the rate of 2% per annum. At this rate how many years will it take for the population to grow 50%?
2. The ABC Mill produces cotton denim. The fixed monthly cost is \$9000, while the variable cost per yard of denim is \$ 0.15 per yard plus an upcoming per yard labour cost under negotiation with the union. The Mill sells a yard of denim for \$1.40. If monthly sales are 20,000 yards, what is the most ABC should be willing to pay the union (on a per yard basis) in order to have a minimum monthly profit of \$9,800?
3. The two partners in a business are splitting up. They each own 50% of the business. The sole assets of the business are two pieces of land, one worth \$100,000 and the other \$50,000. These two pieces have mortgages of respectively \$80,000 and \$20,000. It is proposed that one of the partners take the \$100,000 piece of land together with the \$80,000 mortgage while the other partners takes the \$50,000 piece of land together with the \$20,000 mortgage. What further amount should be transferred between the partners to achieve an equitable division?
4. As an accountant, your clients expect that you will be able to tell them the rate of return they have earned on their investments. Suppose an investor buys a stock for \$12.00 and 4 years later sells it for \$19.00. If no dividends were received over the first 3 years but the investor received a dividend of \$2.00 at the end of the fourth year, calculate the annualized realized rate of return.
5. The manager of the Skookumchuk mining operation of GoldCo estimates that after an investment of \$100 million, her mine will produce gold valued at \$10 million for each of the next 10 years. Is this a good investment?
6. Starting today, you deposit \$400, \$600 and \$700 at the beginning of each year respectively. If your money was earning 3% per year, how much would you have in your account on the day you received the last payment?
7. A real estate firm owns a block of 70 apartments. At \$250 per month, every apartment can be rented. However, for each \$10 per month increase there will be two vacancies with no possibility of filling them. The firm wants to maximize the revenue from rents. What rent should be charged for each apartment. Assume that all apartments are rented out at the same rent.
8. A bank is paying 4% per year compounded annually on all deposits. At the beginning of each year starting today, an investor deposits \$200 for a total of 6 yearly deposits. How much will be in the account at the beginning of the 8th year?
9. Find the slope of the line containing $(x, 3x)$ and $(x+h, 3(x+h))$.
10. Solve for x : $2x^2 + 7x - 4 = 0$

11. Solve for x:

$$\frac{4x+3}{6} - \frac{4x-1}{9} = \frac{1}{2}$$

12. Solve for x: $2 - x - \sqrt{x-1} = 0$

13. When the price was set at \$8.00, 500 units were demanded by customers. When the price was dropped to \$6.00, 900 units were demanded. If this price - quantity relationship is linear, determine this relationship. Estimate the number of units that would likely be demanded if the price was set at \$6.20?
14. Ace Manufacturing Ltd. produced 800 ski racks last month at a total cost of \$37,000. This month they produced 1200 racks at a cost of \$51,000. Assuming that there was no change in fixed costs between the two months and that total cost, $TC(q)$, is a linear function of quantity produced, q , derive the total cost function of Ace. If the racks sell for \$45 each, what is the breakeven production level for Ace?
15. You are the owner of a 30 unit youth hostel. All units are occupied when you charge \$20 per day but for each increase of \$1.00 per day, occupancy drops by 1 unit. If the hostel owner is interested in maximizing revenue, what unit rate should be charged? (Hint: Use Excel to determine this number? Should the owner consider expanding the number of units available by dropping his price by \$1.00 per day on all units rented? Explain.
16. In 1895, the first US Open Golf Championship was held. The winner's prize money was \$150. In 2012, the winner's prize money was \$1,440,000. What was the average annual percentage increase in the prize money over this period?
17. Determine the amount at the end of 20 years deposited in a Tax Free Savings Account (TFSA) if \$5,000 is deposited at the beginning of each year for 20 years with an interest rate of 6% per year. Determine this amount in "after-tax" dollars if the marginal tax rate is 45%.

How to score this test

There are 17 questions in this self assessment test. A score of 76% or higher (13 out of 17) might indicate that your background knowledge is sufficient and you should consider NOT taking the preparation course in quantitative methods. However, if you missed 2 or more questions in the same subject area (such as algebra for example), it indicates a need to "brush up" in this area. In this situation, taking the quantitative methods preparation course would be advised.



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Quantitative Methods Preparation Session Self-Assessment Test Solutions 2013

The following pages provide the solutions for the self-assessment tests and a grading scheme.
Please complete the self assessments before reviewing the solutions.

Quantitative Methods Self-Assessment Test Solutions (2013)

1. Want to know what is "n" such that $(1.02)^n = 1.5$. Take logs of both sides to get
 $n = \log 1.5 / \log 1.02 = 20.48$.

Comment: You will need to know something about logs and compound interest.

2. $TR - TC \geq 9,800$
 $1.40q - [9,000 + (0.15+x)q] \geq 9,800$

But $q = 20,000$ so,

$$1.40(20,000) - [9,000 + (0.15+x) 20,000] \geq 9,800$$
$$X \geq \$0.31 \text{ per yard}$$

Comment: This question relies on some knowledge of basic algebra.

3. If "A" gets the \$100k piece of land with the \$80k mortgage then "A" receives a net benefit of \$20k. The other partner, B, has a net benefit of \$30k. Thus to equalize the net benefits, B would have to give "A" \$5k, leaving each partner with a net benefit of \$25k.

Comment: Very elementary algebra.

4. $FV = P (1 + r)^n$
 $21 = 12 (1 + r)^4$
 $r = 0.15016$ or 15.016%

Comment: This is an example of compound interest and basic equation solving using 4th roots.

5. This is not a good investment. In this example, you invest \$100 million today and receive your \$100 million back spread over 10 years with no additional money paid to compensate you for waiting. For an investment to be attractive, the net present value, $NPV > 0$. In this case, for any reasonable rate of return that investors would expect, the NPV is negative.

Comment: This is a basic example of the Time Value of Money (TVM).

6. \$1,742.36

Comment: A basic example of compounding.

7. Note that the price/demand relationship is linear and can be written as $p = -5q + 600$ where p = price and q = quantity demanded. Since Total Revenue (TR) = price * quantity, our Total Revenue function becomes:

$$TR = (-5q + 600) * q$$

Differentiating this function yields that when $q = 60$, total revenue is maximized at \$18,000 and the price of each apartment should be \$300 per month.

Comment: An elementary example of calculus.

8. We want the value of these 6 equal deposits at the beginning of year 8. This is an annuity question.

$$\text{Value at beginning of year 8} = 200\{(1+.04)^6 - 1\}/.04 * (1.04)^2 = \$1434.85$$

Comment: A basic example of an annuity

9. Slope = 3

Comment: A basic example of the slope formula.

10. $X = \frac{1}{2}$ and $x = -4$

Comment: A basic example of solving using the quadratic formula.

11. $X = -1/2$

Comment: A basic example of solving a one variable equation.

12. $X = 1.382$ (rounded). (Note that the "other" answer 3.618 (rounded) is rejected).

Comment: A more complex example of solving a one variable equation.

13. $P = -.005q + 10.5$ and $q = 860$

Comment: An application example of the slope formula.

14. $TC = 35q + 9,000$ and breakeven at 900 units

Comment: A basic example of solving a simultaneous linear system of equations

15. Using Excel, you need to create data that looks like this:

Price (\$)	20	21	22	23...
Quantity (units)	30	29	28	27...
TR (\$)	600	609	616	621...

Since Total Revenue (TR) = price x quantity, you will quickly see from the chart that TR is maximized where quantity = 25 units and price = \$25.

If you graph this data (quantity vs. TR) you will see that there is no point in expanding the number of units beyond 30. As you can observe from the graph, TR actually decreases for each additional unit supplied beyond 30 units. So, do not expand the number of units available.

Comment: A basic example of using Excel.

16. 8.15%

Comment: A basic example of solving for “r” in the equation: $FV = P(1 + r)^n$

17. TFSA value at year 20: \$194,963.63 (if invested in a non-taxable account (TFSA))
TFSA value at year 20: \$143,099.34 (if invested in a taxable savings account (non-TFSA))

Comment: A slightly more complicated example of an annuity.

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