

STUDY GUIDE

QUADRATIC FUNCTIONS ①

2 FORMS $\left\{ \begin{array}{l} \text{Standard Form: } y = f(x) = ax^2 + bx + c \\ \text{vertex form: } y = a(x-h)^2 + k \text{ (h changes sign, k does not!)} \end{array} \right.$

y-intercept: make $x = 0$

x-intercept: Factor or $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vertex: $V\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$ where $\Delta = b^2 - 4ac$

axis of symmetry min/max value \Rightarrow if a is \oplus min, if a is \ominus max.

Revenue Function: $R(x) = P(x) \cdot x$

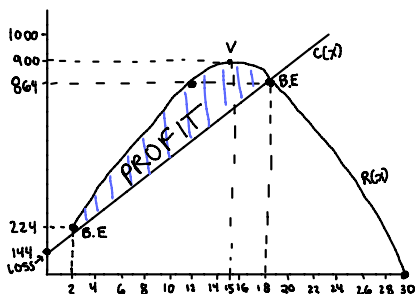
Total cost profit: revenue - cost

maximum profit: y-value of vertex

Output level to achieve max profit: x value of vertex

Break-even points: $R(x) = C(x)$, to find y put both x values into $R(x)$ or $C(x)$.

Example of Graph:



Solving for x ②

- Properties of Logarithms:**
- $\log_b 1 = 0$
 - $\log_b b = 1$
 - $\log_b b^x = x$
 - $b^{\log_b x} = x$
 - $\log_b(MN) = \log_b M + \log_b N$
 - $\log_b\left(\frac{M}{N}\right) = \log_b M - \log_b N$
 - $\log_b(M^r) = r \log_b M$
 - $\log_b M = \log_b N \Rightarrow M = N$
 - $\log_b X = y \Rightarrow b^y = X$

* Reject negative solutions

Laws of exponents:

- $a^x a^y = a^{x+y}$
- $\frac{a^x}{a^y} = a^{x-y}$
- $(a^x)^y = a^{xy}$
- $(ab)^x = a^x b^x$
- $\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
- $(a^x b^y)^z = a^{xz} b^{yz}$
- $\left(\frac{x}{y}\right)^{-a} = \left(\frac{y}{x}\right)^a$
- $a^0 = 1$
- $a^{-x} = \frac{1}{a^x}$
- $a^x = a^y \Rightarrow x = y$

Arithmetic Sequences

- $a_n = a_1 + (n-1)d$
- $S = \frac{\# \text{ of terms}}{2} (1^{\text{st}} \text{ term} + \text{last term})$

Geometric Series

- $a_n = a_1 \cdot r^{n-1}$
- $S = 1^{\text{st}} \text{ term} \left[\frac{1-r^{\# \text{ of terms}}}{1-r} \right]$

Sum of infinite geometric series: $S_\infty = \frac{1^{\text{st}} \text{ term}}{1-r}$ (provided $|r| < 1$)

Word Problems

Compound Interest: $A = P(1+i)^n$ $i = \frac{r}{m}$ $n = mt$

Ex. How long money takes to grow to amount with interest compounded monthly/annually/semi-annually etc.

Continuous Interest: $A = Pe^{rt}$

Ex. How long it takes money to grow to amount if interest compounded continuously. (if m goes to ∞)

Simple Interest: $A = P(1+rt)$ $t = \frac{\text{time}}{\text{total ex. 6 months: } \frac{6}{12}}$

Typically used in the short term \rightarrow < one year.

* Always 360 days a year unless stated otherwise.

Ex. You paid amt to loan company for use of \$x for days, what annual interest rate are you being charged?

Also, T-Bills!

Future Value of annuity: $FV = PMT \left(\frac{(1+i)^n - 1}{i} \right)$ Sometimes: $PMT = FV \left(\frac{i}{(1+i)^n - 1} \right)$

F.V. = Future Value PMT = Equal periodic pmts $i = \frac{r}{m}$ $n = \#$ of pmts/period (mt)

Total Interest = $FV - n \text{ PMT}$ Ex. What is value of annuity at end of x yrs if equal payment deposited every x months into acct earning x% annually/semi-annually etc.

Present Value of annuity: $PV = PMT \left(\frac{1 - (1+i)^{-n}}{i} \right)$ PV = present value.

Total Interest = $n \text{ PMT} - PV$ Ex. A lump sum invested today with objective of obtaining a series of equal periodic pmts over some future time period.

Also used for amortization ex. mortgage, car loan, etc.