**FORMULA SHEET**

**Microeconomics**

**Allocative Efficiency Condition**

\[ P = MC, \text{ or more precisely,} \]

\[ \text{Marginal Social Benefit (MSB)} = \text{Marginal Social Cost (MSC)} \]

**Average Fixed Cost**

\[ \text{AFC} = \frac{\text{Total Fixed Cost (TFC)}}{\text{Quantity of Output (Q)}} \]

**Average Product**

\[ \text{AP} = \frac{\text{Total Product}}{\text{Quantity of Input}} \]

**Average Profit**

\[ \text{Average Profit} = \frac{\text{Total Profit}}{\text{Quantity}} \]

**Average Revenue**

\[ \text{Average Revenue} = \frac{\text{Total Revenue}}{\text{Quantity}} \]

**Average Total Cost**

\[ \text{ATC} = \frac{\text{Total Cost (TC)}}{\text{Quantity of Output (Q)}} \]

**Average Variable Cost**

\[ \text{AVC} = \frac{\text{Total Variable Cost (TC)}}{\text{Quantity of Output (Q)}} \]
Cross-Price Elasticity of Demand
Percentage Change in Quantity Demanded of Good X
-----------------------------------------------
Percentage Change in Price of Good Y

Distributive Efficiency Condition
\[ \frac{\text{MU}_F}{P_F} = \frac{\text{MU}_C}{P_C} \]

Elasticity of Supply
Percentage Change in Quantity Supplied
-----------------------------------------------
Percentage Change in Price

(Use the point or arc formula as indicated below for the price elasticity of demand, substituting the quantity supplied for the quantity demanded.)

Factor of Production Hiring Rule: Hire Until

MRP = MFC (in other books, MFC is sometimes called MRC)

Gini Coefficient

![](image)

shaded area

area of triangle ABC

Marginal Cost
\[ MC = \frac{\Delta TC}{\Delta Q} = \frac{\Delta TVC}{\Delta Q} \]
Marginal Product of Labor

\[ MP_L = \frac{\Delta TP}{\Delta L} \]

Marginal Revenue

\[ MR = \frac{\Delta TR}{\Delta Q} \]

Marginal Revenue Product of Labor (MRPₖ)

\[ MRP_L = MP_L \times MR_{output} \]

Optimal Combination of Resources Condition

\[ \frac{MP_L}{w} = \frac{MP_K}{r} \]

Optimal Consumption Rule

\[ \frac{MU_X}{P_X} = \frac{MU_Y}{P_Y} \]

Price Elasticity of Demand

Simple “Point” Formula

\[ \frac{\%\Delta Q_d}{\%\Delta P} = \frac{\Delta Q_d}{Q} = \frac{Q_{new} - Q_{old}}{P_{new} - P_{old}} \]

More Precise “Arc” Formula

\[ \frac{Q_{new} - Q_{old}}{\left(\frac{Q_{new} + Q_{old}}{2}\right)} \]

\[ \frac{P_{new} + P_{old}}{\left(\frac{P_{new} + P_{old}}{2}\right)} \]
Price for a Competitive Firm

\[ P = MR = AR \]

Production Efficiency Condition

\[ \frac{w}{r} = \frac{MP_l}{MP_k} \text{ or } \frac{MP_k}{r} = \frac{MP_l}{w} \text{ or } r = \text{ min } ATC \]

Profit

Profit = TR – TC

Profit-Maximizing Output Level (if output should be produced at all), rule for finding

MR = MC

Slope

\[
\text{Rise} \quad \frac{\text{Run}}{\text{Rise}} = \text{Marginal Product}
\]

Slope of the Total Product Curve

\[
\frac{\text{Rise}}{\text{Run}} = \frac{\text{Change in Total Product}}{\text{Change in the Number of Units of an Input}} = \text{Marginal Product}
\]

Socially Optimal Level of Output

MSB = MSC

Total Costs

Total Costs = Total Fixed Costs + Total Variable Costs, \( TC = TFC + TVC \)
MACROECONOMICS

Aggregate Expenditure in a Simple Model Without Government or Foreign Sectors

\[ AE = C + I \]

**Allocative Efficiency Condition**

\[ P = MC, \text{ or more precisely, } \]
Marginal Social Benefit (MSB) = Marginal Social Cost (MSC)

**Autonomous Spending Multiplier**

\[ \text{Multiplier} = \frac{1}{1 - MPC} = \frac{1}{MPS} \]

**Balanced Budget Multiplier**

\[ \text{Balanced Budget Multiplier} = \frac{1}{1 - MPC} + \left( \frac{-MPC}{1 - MPC} \right) = \frac{1 - MPC}{1 - MPC} = 1 \]

**Bank’s Reserve Ratio**

\[ \text{Reserve Ratio} = \frac{\text{Bank Reserves}}{\text{Total Deposits}} \]

**Budget Deficit**

Budget Deficit = Federal Government Spending – Tax Collections
(A negative deficit indicates a surplus.)

**Financial Account Balance**

Financial Account Balance =
Foreign Purchases of Home Assets – Home Purchases of Foreign Assets
**Consumer Price Index**

\[
CPI = \frac{\text{Base Year Quantities} \times \text{Current Year Prices}}{\text{Base Year Quantities} \times \text{Base Year Prices}} \times 100
\]

**Consumption Function**

\[C = C_a + MPC(Y)\]

**Current-Account Balance**

Current-Account Balance =
Trade Balance + Services Balance + Unilateral

**Distributive Efficiency Condition**

\[
\frac{MU_F}{P_F} = \frac{MU_C}{P_C}
\]

**Equality of Leakages and Injections**

\[S + T + M = I + G + X\]

**Equation of Exchange**

\[MV = PQ\]

**Gross Domestic Product**

\[GDP = C + I + G + (X - M)\]

\[GDP = NI + \text{Depreciation} + \text{Indirect Taxes} - \text{Subsidies} + \text{Net Income of Foreigners}\]

**Gross Domestic Product Deflator**

\[
\text{GDP Deflator} = \frac{\text{Current Year Quantities} \times \text{Current Year Prices}}{\text{Current Year Quantities} \times \text{Base Year Prices}} \times 100
\]
Income in a Simple Model Without Government or Foreign Sectors

\[ Y = C + S \]

Inflation Between Two Years

Inflation Between Years Y and Z = \[ \frac{\text{CPI in Year } Z}{\text{CPI in Year } Y} - 1 \] \times 100

Marginal Propensity to Consume

\[ \text{MPC} = \frac{\text{Change in Consumption}}{\text{Change in Income}} \]

Marginal Propensity to Save

\[ \text{MPS} = \frac{\text{Change in Saving}}{\text{Change in Income}} \]

Marginal Propensity to Save and Marginal Propensity to Consume Sum

\[ \text{MPC} + \text{MPS} = 1 \]

Merchandise Trade Balance

Merchandise Trade Balance = Value of Merchandise Exports – Value of Merchandise Imports

Nominal Interest Rate

Nominal Interest Rate = Real Interest Rate + Anticipated Inflation

Okun’s Law

% increase in unemployment above natural rate \times 2 = % decrease in output
(The 2 in the equation is an approximation.)
Production Efficiency Condition

\[
\frac{w}{r} = \frac{MP_l}{MP_k}
\]

Real GDP

\[
\frac{\text{Nominal GDP}}{\text{CPI}^* \text{ for the same year as the nominal figure}} \times 100
\]

*CPI or GDP deflator

Real Interest Rate

Real Interest Rate = Nominal Interest Rate – Anticipated Inflation

Rule of 70

Doubling time = \[
\frac{70}{\text{% change per year}}
\]

With 10% inflation, prices double in \[
\frac{70}{10} = 7
\] years.

Slope

Rise
Run

Tax Multiplier

\[
\text{Tax Multiplier} = \frac{\text{MPC}}{\text{MPS}}
\]

Total Amount of Deposits Resulting from an Initial Deposit That Is Ultimately Held as Reserves

Simple Money (or Deposit) Multiplier = \[
\frac{1}{\text{Required Reserve Ratio}}
\]

Unemployment Rate

Unemployed
Labor Force