AP Macroeconomics
Formula Sheet

34 formulas across 6 units · organized by the College Board Course and Exam Description (CED)

How to use this sheet. The AP exam does **not** provide a formula sheet, so every equation below should be memorized. Formulas are grouped by CED unit; each one lists what the variables mean and a quick worked example. "Change in" is written out for clarity.

Unit 1 Basic Economic Concepts

▸ Opportunity Cost (from a PPC)

Opportunity cost = units of one good given up ÷ units of the other good gained

Where: The value of the next-best alternative forgone. A straight-line PPC has constant opportunity cost; a bowed-out PPC has increasing opportunity cost.

Example: *Producing 4 more consumer goods means giving up 8 capital goods → opportunity cost of 1 consumer good = 2 capital goods.*

▸ Comparative Advantage & Terms of Trade

OC of 1 unit of a good = (output of the other good) ÷ (output of this good)

Where: A nation should specialize in the good for which it has the lower opportunity cost. Mutually beneficial trade occurs at terms of trade between the two nations' opportunity costs.

Example: *If 1 wheat costs 0.5 steel at home but 2 steel abroad, the home country has the comparative advantage in wheat.*

Unit 2 Economic Indicators and the Business Cycle

▸ Gross Domestic Product (Expenditure Approach)

GDP = C + I + G + (X − M)

Where: C = consumption, I = gross private investment, G = government purchases, X = exports, M = imports. GDP counts only final goods produced within a country in one year.

Example: *C 700 + I 200 + G 300 + net exports (−50) → GDP = $1,150.*

▸ Net Exports

Net Exports (Xn) = Exports − Imports

Where: A positive value is a trade surplus; a negative value is a trade deficit.

Example: *Exports $400B and imports $450B → net exports = −$50B.*

▸ Nominal vs. Real GDP & the GDP Deflator

Real GDP = (Nominal GDP ÷ GDP Deflator) × 100; GDP Deflator = (Nominal GDP ÷ Real GDP) × 100

Where: Real GDP is adjusted for price changes; the GDP deflator is a price index with the base year equal to 100.

Example: *Nominal GDP $1,200B and a deflator of 120 → Real GDP = (1,200 ÷ 120) × 100 = $1,000B.*

▸ Unemployment Rate

Unemployment Rate = (number unemployed ÷ labor force) × 100

Where: Labor force = employed + unemployed (people age 16+ who are working or actively seeking work).
Example: *8 million unemployed in a labor force of 152 million → 8 ÷ 152 × 100 = 5.3%.*

▸ Labor Force Participation Rate

LFPR = (labor force ÷ working-age population) × 100

Where: The share of the adult (working-age) population that is in the labor force.
Example: *A labor force of 160M out of a 250M working-age population → 64%.*

▸ Consumer Price Index (CPI)

CPI = (cost of the market basket now ÷ cost of the basket in the base year) × 100

Where: Tracks the price of a fixed basket of goods and services bought by a typical household.
Example: *The basket costs $260 now and cost $200 in the base year → CPI = 130.*

▸ Inflation Rate

Inflation Rate = [(new CPI − old CPI) ÷ old CPI] × 100

Where: The percentage change in the price level (usually the CPI) between two periods.
Example: *CPI rises from 120 to 126 → inflation = 6 ÷ 120 × 100 = 5%.*

▸ Real Interest Rate (Fisher Equation)

Real interest rate = Nominal interest rate − Expected inflation rate

Where: Rearranged: Nominal interest rate = Real interest rate + Expected inflation rate.
Example: *A 7% nominal interest rate with 3% expected inflation → real interest rate = 4%.*

▸ Real (Inflation-Adjusted) Value

Real value = (Nominal value ÷ Price index) × 100

Where: Converts a current-dollar amount into constant base-year purchasing power.
Example: *A $50,000 salary when CPI = 125 → real income = (50,000 ÷ 125) × 100 = $40,000.*

▸ Rule of 70

Years to double = 70 ÷ annual growth rate (in %)

Where: A quick estimate of how long it takes a value (real GDP, prices, savings) to double.
Example: *Real GDP growing 3.5% per year doubles in 70 ÷ 3.5 = 20 years.*

▸ Real GDP Growth Rate

Growth rate = [(new Real GDP − old Real GDP) ÷ old Real GDP] × 100

Where: Real GDP per capita = Real GDP ÷ population, the standard measure of living standards.
Example: *Real GDP rises from $1,000B to $1,030B → growth rate = 30 ÷ 1,000 × 100 = 3%.*

▸ Costs of Unemployment & Inflation

Natural rate of unemployment = frictional + structural unemployment

Where: Cyclical unemployment is zero when the economy is at full employment; nominal wages or values can be deceptive when prices change.

Example: *If frictional unemployment is 3% and structural is 2%, the natural rate is about 5%.*

Unit 3 National Income and Price Determination

▸ Marginal Propensity to Consume (MPC)

MPC = (change in consumption spending) ÷ (change in disposable income)

Where: The fraction of each additional dollar of disposable income that households spend.

Example: *Disposable income rises $100 and consumption rises $80 → MPC = 80 ÷ 100 = 0.8.*

▸ Marginal Propensity to Save (MPS)

MPS = (change in saving) ÷ (change in disposable income); MPC + MPS = 1

Where: The fraction of each additional dollar of disposable income that households save.

Example: *If MPC = 0.8, then MPS = 1 − 0.8 = 0.2.*

▸ Spending (Expenditure) Multiplier

Spending multiplier = 1 ÷ (1 − MPC) = 1 ÷ MPS

Where: Magnifies how a change in autonomous spending (C, I, G, or Xn) changes real GDP.

Example: *MPC = 0.8 → spending multiplier = 1 ÷ (1 − 0.8) = 1 ÷ 0.2 = 5.*

▸ Tax Multiplier

Tax multiplier = −MPC ÷ (1 − MPC) = −MPC ÷ MPS

Where: Smaller in absolute size than the spending multiplier and negative — a tax cut raises GDP.

Example: *MPC = 0.8 → tax multiplier = −0.8 ÷ 0.2 = −4.*

▸ Change in Real GDP

Change in real GDP = spending multiplier × change in spending (or tax multiplier × change in taxes)

Where: The full effect on equilibrium output of a fiscal or autonomous-spending shock.

Example: *A $20B rise in government spending with a multiplier of 5 → real GDP rises by $100B.*

▸ Balanced-Budget Multiplier

Balanced-budget multiplier = 1

Where: An equal increase in government spending and taxes raises real GDP by the size of that change.

Example: *Government spending and taxes each rise $20B → real GDP rises by $20B.*

Unit 4 Financial Sector

▸ Required Reserves

Required reserves = required reserve ratio × demand deposits

Where: The minimum amount a bank must hold against its deposits and cannot lend out.

Example: *A 10% reserve ratio on $1,000 of deposits → required reserves = $100.*

▸ Excess Reserves

Excess reserves = total reserves − required reserves

Where: The amount a bank is free to lend; new loans create new money in the banking system.

Example: *Total reserves $250 and required reserves $100 → excess reserves = $150.*

▸ Money (Deposit) Multiplier

Money multiplier = 1 ÷ required reserve ratio

Where: The maximum factor by which the banking system can expand the money supply from new reserves.

Example: *A required reserve ratio of 0.10 → money multiplier = 1 ÷ 0.10 = 10.*

▸ Maximum Change in the Money Supply

Maximum change in money supply = excess reserves × money multiplier

Where: The largest possible expansion; the actual change is smaller if banks hold extra reserves or the public holds cash.

Example: *$150 of excess reserves with a multiplier of 10 → up to $1,500 of new money.*

▸ Quantity Theory of Money

$M \times V = P \times Q$

Where: M = money supply, V = velocity of money, P = price level, Q = real output. P × Q equals nominal GDP.

Example: *Money supply $500B with a velocity of 8 → nominal GDP (P × Q) = $4,000B.*

▸ Real Interest Rate & Bond Prices

Real interest rate = nominal interest rate − inflation rate

Where: Bond prices and interest rates move in opposite directions — when rates rise, bond prices fall.

Example: *A bond paying 6% nominal with 2% inflation gives the holder a 4% real return.*

Unit 5 Long-Run Consequences of Stabilization Policies

▸ Money Growth and Inflation (Long Run)

% change in M + % change in V = % change in P + % change in real GDP

Where: The quantity theory in growth-rate form. With stable velocity and full-employment output, faster money growth becomes inflation one-for-one.

Example: *If money grows 5% with stable velocity and 3% real growth, inflation is about 2%.*

▸ Phillips Curve Relationship

Short run: inflation and unemployment move inversely. Long-run Phillips curve is vertical at the natural rate of unemployment.

Where: There is a short-run trade-off between inflation and unemployment but no long-run trade-off.

Example: *Expansionary policy lowers unemployment below the natural rate only temporarily, at the cost of higher inflation.*

▸ Crowding Out

Government borrowing → higher demand for loanable funds → higher real interest rate → less private investment

Where: Reduces the effectiveness of expansionary fiscal policy that is financed by borrowing.

Example: *A larger budget deficit raises the real interest rate, discouraging firms' investment spending.*

▸ Real Interest Rate (Loanable Funds Market)

Real interest rate = nominal interest rate − expected inflation rate

Where: The real interest rate is set in the loanable funds market by the supply of and demand for savings.

Example: *More government borrowing shifts loanable-funds demand right, raising the real interest rate.*

Unit 6 Open Economy — International Trade and Finance

▸ Balance of Payments

Current Account + Capital (Financial) Account = 0

Where: The current account (net exports + net income + net transfers) is offset by the capital/financial account (net flows of financial assets).

Example: *A current account deficit of $100B is matched by a capital account surplus of $100B.*

▸ Net Exports

Net Exports = Exports − Imports

Where: A major component of both GDP and the current account of the balance of payments.

Example: *Exports of $400B and imports of $450B → net exports = −$50B.*

▸ Exchange Rates: Appreciation & Depreciation

Exchange rate = the price of one currency in terms of another

Where: Appreciation means a currency buys more foreign currency; depreciation means it buys less. A weaker currency makes exports cheaper and imports more expensive.

Example: *If $1 goes from €0.80 to €0.90, the dollar has appreciated against the euro.*

▸ Real Interest Rates & International Capital Flows

Higher domestic real interest rate → more financial capital inflow → higher demand for the currency → appreciation

Where: Links the loanable funds market, the foreign exchange market, and net exports.

Example: *A rise in U.S. real interest rates attracts foreign investment, raising demand for the dollar.*