Math 34 Formulas

Simple Interest Formula \[ I = PRT \]
\( I \) = simple interest
\( P \) = principal
\( R \) = rate
\( T \) = term

Nth Term of An Arithmetic Sequence \( a_n = a_1 + (n-1)d \)
\( a_1 \) = first term
\( d \) = common difference

Sum of the First \( n \) Terms of an Arithmetic Sequence
\( S_n = \frac{n}{2}(a_1 + a_n) \)
\( a_1 \) = first term
\( a_n \) = \( n \)th term

Simple Discount Formula \[ D = Mt \]
\( D \) = simple discount
\( M \) = maturity value
d = interest discount rate
\( T \) = term

Compound Interest Formula \[ FV = PV(1 + i)^n \]
\( FV \) = future value
\( PV \) = present value
\( i \) = interest rate per compounding period
\( n \) = number of compounding periods

N\textsuperscript{+1} Term of a Geometric Sequence \( a_n = a_0 r^n \)
\( a_0 \) = first term
\( a_1 \) = second term
\( r \) = common ratio = \( a_1/a_0 \)

Sum of the First \( n \) Terms of a Geometric Sequence
\( S_n = \frac{a_0(1 - r^n)}{1 - r} \)
\( a_0 \) = first term
\( r \) = common ratio = \( a_1/a_0 \)

Infinite Geometric Sum
\( S_\infty = \frac{a_0}{1 - r} \)
\( a_0 \) = first term
\( r \) = common ratio = \( a_1/a_0 \)

Compound Interest Rate
\[ i = \left( \frac{FV}{PV} \right)^{1/n} - 1 \]
i = compound interest rate
\( FV \) = future value
\( PV \) = present value
\( n \) = number of compounding periods

Time Periods
\[ n = \frac{\log(FV/PV)}{\log(1 + i)} \]
i = compound interest rate
\( FV \) = future value
\( PV \) = present value

Rule of 72
The time required for a sum of money to double at a compound interest rate of \( x\% \) is approximately 72/x years. (\( x \) should not be converted to a decimal)

Rule of 72 (Alternate Form)
The compound interest rate required for a sum of money to double in \( x \) years is approximately 72/x percent.

Effective Interest Rate
\[ \text{Eff. Rate} = (1 + r/c)^c - 1 \]
r = the nominal interest rate
c = the number of compoundings per year

Continuous Compounding
\[ FV = PV e^{rt} \]
\( FV \) = future value
\( PV \) = present value
e = a mathematical constant (approx. 2.71828)
r = annual interest rate
t = number of years

Future Value Annuity Factor
\[ S_{n/i} = \frac{(1+i)^n - 1}{i} \]
i = interest rate per payment period
\( n \) = number of payment periods

Future Value of an Ordinary Annuity
\[ FV = PMTs a_{n/i} \]
\( FV \) = future value of the annuity
\( PMT \) = amount of each payment
\( a_{n/i} \) = annuity factor

Future Value of an Annuity Due
\[ FV = PMTs a_{n/i}(1 + i) \]
\( FV \) = future value of the annuity
\( PMT \) = amount of each payment
\( i \) = interest rate per payment period
\( a_{n/i} \) = annuity factor

Interest for Future Value Annuities
interest = \( FV \) - total deposits

Present Value Annuity Factor
\[ a_{n/i} = \frac{1 - (1+i)^{-n}}{i} \]
i = interest rate per payment period
\( n \) = number of payment periods

Present Value of an Ordinary Annuity
\[ PV = PMTa_{n/i} \]
\( PV \) = present value of the annuity
\( PMT \) = amount of each payment
\( a_{n/i} \) = present value annuity factor

Present Value of an Annuity Due
\[ PV = PMTa_{n/i}(1 + i) \]
\( PV \) = present value of the annuity
\( PMT \) = amount of each payment
\( a_{n/i} \) = present value annuity factor

Interest for Present Value Annuities
interest = total deposits - \( PV \)
Sales Tax  \[ T = P(1 + r) \]
- \( T \) = total price including tax
- \( P \) = price before tax
- \( r \) = sales tax rate
- \( T - P \) = amount of tax

Income Tax Formulas
- Annual taxable income = annual income - benefits
  - exemptions
  - deductions
- Paycheck taxable income = paycheck income - benefits - exemptions
- FICA taxes based on paycheck income - benefits

Dividends
- \( \text{price/share} = \frac{\text{total dividend}}{\text{total # shares}} \)
- \( \text{individual dividend} = (\text{price/share})(\# \text{ individual shares}) \)

Current dividend yield
- \( \frac{(1/4)(\text{quarterly dividend rate})(\text{market price per share})}{\text{market price per share}} \)

Trailing divided yield
- \( \frac{(\text{trailing dividend rate})(\text{market price per share})}{\text{market price per share}} \)

Rate of Return
- \( i = \left( \frac{FV}{PV} \right)^{1/n} - 1 \)
- \( i \) = rate of return
- \( FV \) = future value
- \( PV \) = present value
- \( n \) = number of years

Net Asset Value (NAV)
- \( \text{NAV} = \text{total assets} / \text{total number of shares} \)

Mutual Fund Shares
- \( \# \text{ shares} = \text{amount invested} / \text{NAV} \)

Inflation Formula
- \( FV = PV(1 + i)^n \)
- \( FV \) = future value of an item
- \( PV \) = present value of an item
- \( i \) = rate of inflation
- \( n \) = number of time periods

Declining Balance Depreciation
- \( FV = PV(1 + i)^n \)
- \( FV \) = future value
- \( PV \) = present value
- \( i \) = depreciation rate
- \( n \) = years

Straight Line Depreciation
- Total depreciation amount = \( \text{Original value} - \text{Residual value} \)
- Annual depreciation = \( \frac{\text{Total depreciation amount}}{\text{Useful Life}} \)
- Depreciated value = \( \text{Original value} - (\# \text{ of years})(\text{Annual depreciation}) \)

Credit Card Interest
- \( I = PRT \)
- \( I \) = interest
- \( P \) = principal
- \( R \) = interest rate
- \( T \) = term

Mortgage Formulas
- \( \text{Equity} = \text{value of home} - \text{amount of mortgage} \)
- \( \text{Total PITI} = \text{principal} + \text{interest} + \text{taxes} + \text{insurance(s)} \)
- One point = 1% of the amount of the loan
- Payback period = cost of points/monthly savings

The 28% Rule
- Total PITI cannot exceed 28% of gross monthly income

The 36% Rule
- Total PITI and all other long-term debt payments cannot exceed 36% of gross monthly income.

Lease Payment = Payment on Loss + Interest on Residual
- Payment on loss: \( \text{Use } PV = \text{PMT}_{a/i} \text{ where } PV = \text{original price} - \text{residual value} \)
- Interest on residual: \( \text{Use } I = \frac{PV - \text{residual value}}{r} \)

Markup Based on Cost
- \( P = C(1 + r) \)
- \( P \) = selling price
- \( C \) = cost
- \( r \) = percent markup

Markup Based on Selling Price
- \( C = SP(1 - r) \)
- \( C \) = item’s cost
- \( SP \) = selling price
- \( r \) = gross profit margin

Markdown
- \( MP = OP(1 - d) \)
- \( MP \) = marked-down price
- \( OP \) = original price
- \( d \) = percent markdown

Profit Margin Formulas
- \( \text{Gross profit} = \text{sales} - \text{cost} \)
- \( \text{Gross profit margin} = \frac{\text{gross profit}}{\text{sales}} \)
- \( \text{Gross profit} = \text{gross profit margin} \times \text{sales} \)
- \( \text{Net profit} = \text{sales} - \text{cost} - \text{expenses} \)
- \( \text{Net profit margin} = \frac{\text{net profit}}{\text{sales}} \)

Cost-Revenue Analysis
- \( P = R - C \)
- \( P \) = profit
- \( R \) = revenue
- \( C \) = cost