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
- \( a_n \) = nth term

Simple Discount Formula \[ D = MdT \]
- \( D \) = 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+1\textsuperscript{st} 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 = \( a_1/a_0 \)

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

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

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.

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

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

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

Interest for Future Value Annuities

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 \[ PV = PMT a_{n/i} \]
- \( PV \) = present value of the annuity
- \( PMT \) = amount of each payment
- \( a_{n/i} \) = present value annuity factor

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

Interest for Present Value Annuities

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)
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
price/share = \( \frac{\text{total dividend}}{\text{total # shares}} \)
individual dividend = (price/share)(# individual shares)
current dividend yield
= (quarterly dividend rate x 4)/(market price per share)
trailing divided yield
= (trailing dividend rate)/(market price per share)

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

Net Asset Value (NAV)
NAV = total assets / total number of shares

Mutual Fund Shares
# shares = amount invested / 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
= Original value − Residual value
Annual depreciation = \( \frac{\text{Total depreciation amount}}{\text{Useful Life}} \)
Depreciated value
= Original value − (# of years)(Annual depreciation)

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

Mortgage Formulas
Equity = value of home − amount of mortgage
Total PITI = principal + interest + taxes + 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:  Use \( PV = PMT \frac{a}{i} \)
where
PV = original price − residual value
Interest on residual:  Use \( I = PRT \)
where \( P = \text{residual value} \)

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
Gross profit = sales − cost
Gross profit margin = gross profit /sales
Gross profit = gross profit margin x sales
Net profit = sales − cost − expenses
Net profit margin = net profit/sales

Cost-Revenue Analysis
P = R − C
P = profit
R = revenue
C = cost