How to use Fast Formulas Spreadsheets

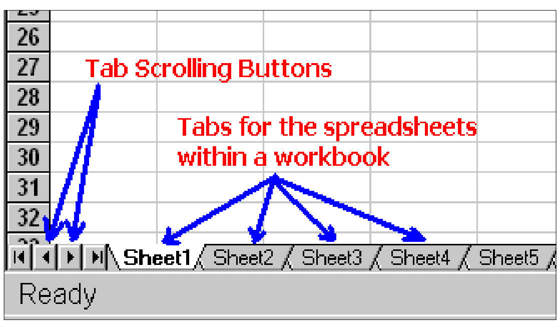
The tabs at the bottom of the spreadsheet contain different subjects.
Click on one of the tabs to display the subject that interests you.

Enter values into the light blue cells, the ones that look like this one:

When you have entered values into the cells, the result of the formula appears in the cells with the red border, like this one:

Help Using Spreadsheet Tabs

The spreadsheet tabs in Microsoft Excel are located at the bottom-left side of the Excel Window as shown here:

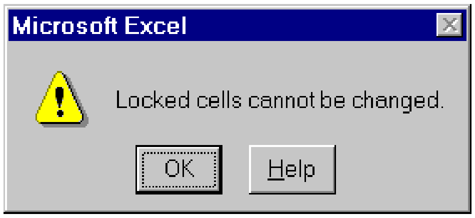


To switch between sheets in a workbook, click the sheet tab for the sheet you want to work on.

If you don't see the tab you want, click the tab scrolling buttons to display the tab. Then click the tab.

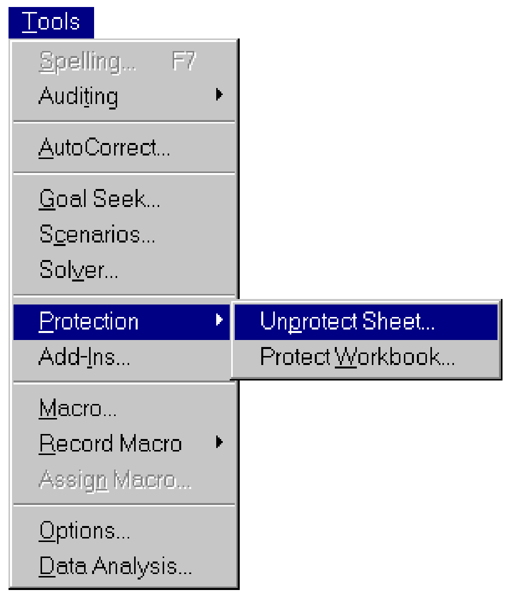
Protected Cells

When you attempt to change cells that are not light blue-colored ( )
a message box appears that looks like this:



This is because the sheets are "protected" so that they are not accidentally disturbed in unintended ways.

However, if you are comfortable working with formulas in MS Excel, you may wish to edit the formulas to adapt them to other uses. You can easily disable the protection feature as follows:



1 Select the tab that you wish to "Un-Protect"

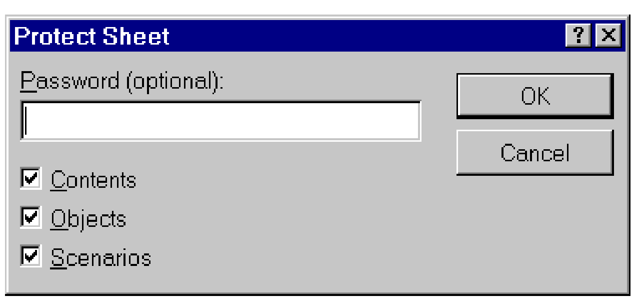
2 Click the Tools menu, and choose the Protection menu item and then click "Unprotect Sheet..."

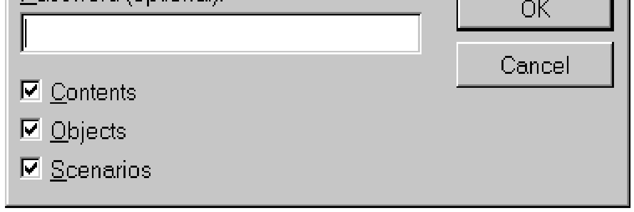
3 The sheet is now unprotected, allowing you to make any changes you wish. BE CAREFUL!

You can easily "re-protect" a sheet that you have unprotected, as follows:

1 Select the tab that you wish to protect

2 Click the Tools menu, and choose the Protection menu item and then click "Protect Sheet..."
The following dialog box will appear:





3 To protect the sheet without requiring a password to unprotect it later, click the OK button.

To protect the sheet so that a password is required to unprotect it later, type a password into the box, and then click the OK button.
DON'T FORGET THAT PASSWORD! WRITE IT DOWN SOMEWHERE.
Fast Formulas can not rescue you from forgotten passwords!

fast formulas

www.fastformulas.com

Thank you for purchasing this spreadsheet from Fast Formulas. We hope that you find it useful.

We offer interactive spreadsheets in the following areas, and are in the process of developing others.

- Business: Accounting
- Business: Finance
- Business: Marketing
- Business: Statistics
- Business: Operations Management
- Engineering: Economics
- Civil Engineering: Statics
- Civil Engineering: Dynamics
- Electrical Engineering: AC Circuits
- Electrical Engineering: DC Circuits
- Electrical Engineering: Electronics
- Electrical Engineering: Electrostatics
- Electrical Engineering: Three Phase
- Electrical Engineering: Rotating Machines
- Mechanical Engineering: Fluids - Properties
- Mechanical Engineering: Fluids - Statics

Technical Support

Unfortunately we are unable to offer general, no-cost technical support. We do, however, offer technical support on a contract basis. If you would like to obtain contract-based technical support, please contact us as indicated below.

Bug Reports

If believe feel that you have identified a bug in our products, please email Customer Service with the following information:

- Your Fast Formulas Username
- Product Name
- Tab Name
- Formula Name
- A description of the problem
- The values for each of the variables in the formula which causes the bug to appear.

We will do our best to resolve the problem as quickly as possible and to provide you with a solution to the problem. We welcome your feedback and appreciate your patience while we find a solution.

Contact Us

Please check out our Frequently Asked Questions (FAQ) page at

http://www.fastformulas.com/ffshop/faq.asp

first to see if we have already addressed your questions.

We can be reached by fax at (520) 563-4905.

We can also be reached by email at the following addresses:

Customer Service	service@fastformulas.com
Requests for new Subjects	requests@fastformulas.com

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Finance Formulas

Financial Ratio Analysis

Tax Rate

Input Data	Year 1	Year 2	Year 3	Year 4
Revenues				
Cost of Goods Sold				
Gross Margin	0	0	0	0
Operating Expenses				
Interest (before tax)				
Income (before tax)	0	0	0	0
Income Tax (Current + Deferred)				
Net Income	0	0	0	0
Dividends				
Cash				
Accounts Receivables				
Other Liquid Current Assets				
Inventory				
Current Assets	0	0	0	0
Property, Plant and Equipment				
Investments and Other Assets				
Total Assets	0	0	0	0
Current Liabilities				
Long Term Debt				
Other Long Term Liabilities				
Total Liabilities	0	0	0	0
Working Capital	0	0	0	0
Shareholders Equity				
Market price per Common Stock share				
Number of Common Stock shares				
Cash Expenses				
Cash from Operations				

Ratios	Year 1	Year 2	Year 3	Year 4
OVERALL				
Price / Earnings (P/E)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Return on Assets (ROA)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Return on Invested Capital (ROIC)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Return on Shareholders Equity (ROSE)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
PROFITABLITY				
Gross Margin % (GM)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Profit Margin	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Earnings Per Share (EPS)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
INVESTMENT UTILIZATION				
Asset Turnover	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Invested Capital Turnover	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Equity Turnover	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Capital Intensity	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Days' Cash	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Days' Receivables (or collection period)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Days' Inventory	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Inventory Turnover	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Working Capital Turnover	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
FINANCIAL CONDITION				
Current Ratio	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Acid Test (Quick Ratio)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Debt / Equity Ratio	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Debt / Capitalization Ratio	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Times Interest Earned	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Cash Flow / Debt	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Dividend Yield	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Dividend Payout	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Fixed Assets Turnover Financial Ratio	Average Sales Per Day
Inventory Turnover Financial Ratio	Cost Of Carrying Receivables
Market / Book Financial Ratio	Credit Score
Price / Earnings Financial Ratio	Days Sales Outstanding
Profit Margin On Sales	Total Cost Of Cash Balances
Quick Financial Ratio Or Acid Test Financial Ratio	Average Inventory
Return On Common Equity	Economic Order Quantity
Return On Total Assets	Inventory Management
Times-Interest-Earned Financial Ratio	Reorder Point
Total Assets Turnover Financial Ratio	Total Carrying Cost
Break Even Quantity	Total Inventory Cost
Break Even Sales	Total Ordering Cost
Cash Operating Break Even Quantity	Annual Percentage Rate
Contribution Margin	Approximate Cost Of Foregoing A Cash Discount
Degree Of Financial Leverage	Compensating Balance Requirement
Degree Of Financial Leverage - If NO Preferred Stock Exists	Effective Annual Rate
Degree Of Financial Leverage - If Preferred Stock Exists	Periodic Rate
Degree Of Operating Leverage	Periodic Rate (Discount)
Degree Of Operating Leverage - At A Particular Operating Level	Required Loan Amount
Degree Of Operating Leverage - At A Particular Sales Level	Usable Funds
Degree Of Total Leverage	Capital Budgeting Evaluation
Degree Of Total Leverage - If NO Preferred Stock Exists	Coefficient Of Variation
Degree Of Total Leverage - If Preferred Stock Exists	Comparison Of Multiple Projects
Earnings Before Interest And Taxes	Expected Net Present Value
Earnings Before Interest And Taxes - Financial Break Even Point	Incremental Operating Cash Flow
Full Capacity Sales	Net Cash Flow
Gross Profit Margin	Net Present Value
Total Cost	Payback
Beta Coefficient Of A Portfolio	Required Rate Of Return For A Project
Coefficient Of Variation	Standard Deviation Of The Net Present Value
Expected Rate Of Return	After Tax Component Cost Of Debt
Expected Rate Of Return On A Portfolio	Bond Yield + Risk Premium Approach To Stock Valuation
Market Risk Premium	Break Point
Security Market Line	Capital Asset Pricing Model
Standard Deviation	Component Cost Of Preferred Stock
Variance	Constant Growth Rate Approach To Stock Valuation
Effective Annual Rate	Cost Of New Common Equity
Future Value	Discounted Cash Flow Approach To Stock Valuation
Future Value Of An Annuity	Marginal Cost Of Capital Schedule
Future Value Of An Annuity Due	Required Rate Of Return
Future Value Of An Uneven Cash Flow Stream	Required Rate Of Return
Future Value With Frequent Compounding	Weighted Average Cost Of Capital
Periodic Interest Rate	Weighted Average Cost Of Capital
Present Value	Degree Of Financial Leverage

Marketing Formulas and Graphs

Total Cost

TC = Total Cost
F = Fixed Costs
V = Variable Cost per unit
Q = Quantity of units produced

TC = F + (V * Q) = F + (V * Q)

[ ] + [ ] * [ ] = [ ]

Break Even Quantity

Q_{BE} = F / (P - V) = F / (P - V)

[ ] / [ ] - [ ] = [ ]

Q_{BE} = Break Even Quantity
F = Fixed Costs
P = Sales Price of item
V = Variable Cost per unit

Q_{BE} = F / (Unit Contribution) = F / Unit Contribution

[ ] / [ ] = [ ]

Contribution Margin

P = Sales Price of item
V = Variable Cost per unit

Contribution Margin = P - V = P - V

[ ] - [ ] = [ ]

Total Contribution

Total Contribution = (P - V) * Q

P = Sales Price of item
V = Variable Cost per unit
Q = Quantity of units produced

Total Contribution = (P - V) * Q

[ ] - [ ] * [ ] = [ ]

Total Revenue = P * Q

[ ] * [ ] = [ ]

Total Variable Cost = V * Q

[ ] * [ ] = [ ]

Total Contribution = Total Revenue - Total Variable Cost

[ ] - [ ] = [ ]

Manufacturer's Margin

Manufacturer's Margin = MFR's Selling Price to Distributors - Manufacturing Cost

[ ] - [ ] = [ ]

Wholesaler's Margin

		Wholesaler's Selling				
Wholesaler's Margin	=	Price to Retailers	-	Price Paid to MFR		
			-		=	

Retailer's Margin

		Retailer's Selling Price				
Retailer's Margin	=	to Consumer	-	Price Paid to Wholesaler		
			-		=	

Operations Management

Queueing Theory (Single Server)

Probability that No Customers are in System $P_0 = 1 - (\lambda / \mu)$

P_0 = Probability that No Customers are in System

λ = Mean Arrival Rate

μ = Mean Service Rate

$P_0 = 1 - ($ λ [ ] / μ [ ] $) =$ [ ]

Probability that the Server is Busy (there are customers)

ρ = Probability that the Server is Busy (there are customers)

λ = Mean Arrival Rate

μ = Mean Service Rate

$\rho = \lambda / \mu$ = λ [ ] / μ [ ] = [ ]

Probability that exactly *n* Customers are in System $P_n = \{ 1 - (\lambda / \mu) \} * \{ (\lambda / \mu)^n \}$

P_n = Probability that *n* Customers are in System

λ = Mean Arrival Rate

μ = Mean Service Rate

n = Number of Customers

$P_n = \{ 1 - ($ λ [ ] / μ [ ] $) \} * ($ λ [ ] / μ [ ] $)^{n\,[\ ]} \} =$ [ ]

Average Number of Customers in the System $L = \lambda / (\mu - \lambda)$

L = Average Number of Customers in the System

λ = Mean Arrival Rate

μ = Mean Service Rate

L = λ [ ] / (μ [ ] - λ [ ]) = [ ]

Average Number of Customers in Queue $L_q = \lambda^2 / (\mu (\mu - \lambda))$

L_q = Average Number of Customers in the Queue

L_q = λ [ ] 2 = [ ]

λ = Mean Arrival Rate

μ = Mean Service Rate

μ	*	(μ	-	λ)
	*		-	

Average Time that a Customer spends in System

W = Average Time that a Customer spends in System

λ = Mean Arrival Rate

μ = Mean Service Rate

$W = 1 / (\mu - \lambda) = \dfrac{1}{\mu - \lambda} =$

Average Time that a Customer spends in Queue

$W_q = \lambda / (\mu (\mu - \lambda))$

W_q = Average Time that a Customer spends in Queue

λ = Mean Arrival Rate

μ = Mean Service Rate

$W_q = \dfrac{\lambda}{\mu * (\mu - \lambda)} =$

Economic Analysis

$TC = (C_W * L) + C_S$

$TC = (C_W * L) + C_S =$

TC = Total Cost

C_W = Waiting Cost per Customer (Opportunity Cost)

L = Average Number of Customers in the System

C_S = Service Cost (wages, operating cost...)

Queueing Theory (Single Server)

Mean Arrival Rate =	λ	
Mean Service Rate =	μ	
Number of Customers =	n	
Waiting Cost per Customer (Opportunity Cost) =	C_W	
Service Cost (wages, operating cost...) =	C_S	
Probability that No Customers are in System =	P_0	
Probability that n Customers are in System =	P_n	
Probability that the Server is Busy (there are customers) =	ρ	
Average Number of Customers in the System =	L	
Average Number of Customers in the Queue =	L_q	

Average Time that a Customer spends in System =	W	
Average Time that a Customer spends in Queue =	W_q	
Total Cost =	TC	

Engineering Economics

Present Worth Method

P = Present Worth
F = Future Worth
i = interest rate
n = number of periods (years)

$P(a) = -P + F(1 + i)^{-n}$

	P	F	i	n		
Option 1					=	

$P(b) = -P + F(1 + i)^{-n}$

	P	F	i	n		
Option 2					=	

The best option is by _

Capitalized Cost Method (Infinite life)

C = Initial Cost
EAA = Equal Annual Amount
(Yearly Maintenance Cost)
i = interest rate

$\text{Capitalized Cost} = C + \frac{EAA}{i}$

C	EAA	i		
			=	

Annualized Cost Method

C = Initial Cost
N_L = Periods (Duration or Life)
EAA = Equal Annual Amount
(Yearly Maintenance Cost)
i = interest rate

	C	EAA	N_L	i		
Option 1					=	
Option 2					=	

The best option is by _

Cost / Benefit Ratio

ic = initial cost
m = cost of maintainence

$B/C = b/(ic + m + v_r)$

b		
	=	

b = user benefits

v_r = residual value

B/C	=	*ic*	*m*	v_r

Electrical Engineering (AC Circuits)

Ideal Transformer - Turns Ratio

a	=	Turns Ratio
N_p	=	Primary Number of Turns
N_s	=	Secondary Number of Turns
V_p	=	Primary Voltage
V_s	=	Secondary Voltage
I_p	=	Primary Current
I_s	=	Secondary Current
Z_p	=	Primary Impedance
Z_s	=	Secondary Impedance
L_p	=	Primary Leakage Flux
L_s	=	Secondary Leakage Flux

$a = N_p / N_s$ = N_p / N_s = a

$a = V_p / V_s$ = V_p / V_s = a

$a = I_s / I_p$ = I_s / I_p = a

$a = \sqrt{(Z_p / Z_s)}$ = √(Z_p / Z_s = a

$a = \sqrt{(L_p / L_s)}$ = √(L_p / L_s = a

Ideal Transformer - Secondary Current

$I_s = V_s / Z_s$ = V_s / Z_s = I_s

I_s = Secondary Current

V_s = Secondary Voltage

Z_s = Secondary Impedance

Ideal Transformer - Effective Primary Impedance

$Z_{ep} = V_p / I_p$ = V_p / I_p = Z_{ep}

Z_{ep} = Effective Primary Impedance

V_p = Primary Voltage

I_p = Primary Current

Z_p = Primary Impedance

Z_s = Secondary Impedance

R_p = Primary Resistance

R_s = Secondary Resistance

X_p = Primary Reactance

X_s = Seconday Reactance

a = Turns Ratio

$Z_{ep} = Z_p + a^2 * Z_s$ = Z_p + a 2 * Z_s = Z_{ep}

$R_p = a^2 * R_s$ = a 2 * R_s = R_p

$X_p = -a^2 * X_s$ = -1 * a 2 * X_s = X_p

Real Transformers

X_p = Primary Reactance
X_s = Secondary Reactance
ω = Angular Frequency
L_p = Primary Leakage Flux
L_s = Secondary Leakage Flux
V_{ploss} = Primary Voltage Loss
V_{sloss} = Secondary Voltage Loss
I_p = Primary Current
I_s = Secondary Current
f = Frequency

ϕ_{mloss} = Maximum Magnetic Flux Loss
N_p = Primary Number of Turns
N_s = Secondary Number of Turns

$X_p = \omega * L_p$ = ω * L_p = X_p

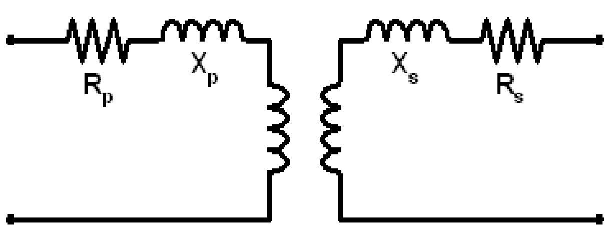
$X_s = \omega * L_s$ = ω * L_s = X_s

$X_p = V_{ploss} / I_p$ = V_{ploss} / I_p = X_p

$X_s = V_{sloss} / I_s$ = V_{sloss} / I_s = X_s

$X_p = 4.44 * f * \phi_{mloss} * N_p / I_p$ = 4.44 * f * ϕ_{mloss} * N_p / I_p = X_p

$X_s = 4.44 * f * \phi_{mloss} * N_s / I_s$ = 4.44 * f * ϕ_{mloss} * N_s / I_s = X_s



Real Tranformers - Power Losses

$P_h = k_h * f * B_m^n$ = k_h * f * B_m ^ n = P_h

$P_e = k_e * f^2 * B_m^2$ = k_e * f ^ 2 * B_m ^ 2 = P_e

$P_{Cu} = I^2 * R$ = I ^ 2 * R = P_{Cu}

P_h = Hysteresis Loss
P_e = Eddy-Current Loss
P_{Cu} = Copper Loss
k_h = Hysteresis Constant
k_e = Eddy-Current Constant
f = Frequency
B_m = Maximum Magnetic Flux Density
n = Steinmetz Exponent (usually 1.6)
I = Current
R = Resistance

Real Tranformers - Transformer Efficiency

$\eta = P_{out} / P_{in}$ = P_{out} / P_{in} = η

$\eta = P_{out} / (P_{out} + P_{los})$ = P_{out} / (P_{out} + P_{los}) = η

$\eta = 1 - P_{los} / P_{in}$ = P_{los} = η

η = Efficiency
P_{out} = Power Out
P_{in} = Power In
P_{los} = Power Lost

= 1 - [ ] = [ ]

P_{in}

[ ]

Series RL Circuit	Transmission Line Reflection Coefficient
Parallel RC Circuit	Transmission Line Standing Wave Ratio
Series RC Circuit	Transmission Line Velocity Factor
Parallel RLC Circuit	Gain
Series RLC Circuit	Impedance Model
Bandwidth	Admittance Model
	Hybrid Model

Electrical Engineering (DC Circuits)

Voltage Divider

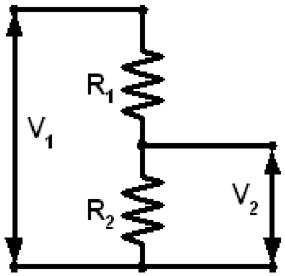
$V_2 = V_1 * R_2 / (R_1 + R_2)$ = V_1 * R_2 / (R_1 + R_2) = V_2

V_1 = Voltage 1

V_2 = Voltage 2

R_1 = Resistor 1

R_2 = Resistor 2



Current Divider

$I_2 = I_1 * R_1 / (R_1 + R_2)$ = I_1 * R_1 / (R_1 + R_2) = I_2

I_1 = Current 1

I_2 = Current 2

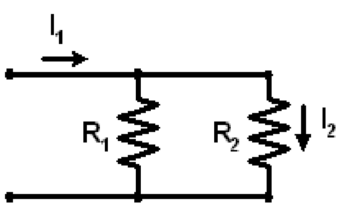
R_1 = Resistor 1

R_2 = Resistor 2

G_1 = Conductance 1

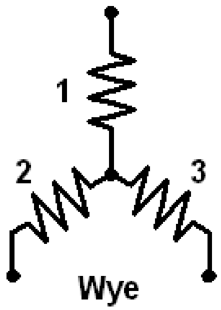
G_2 = Conductance 2

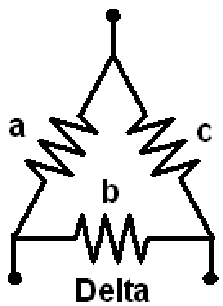
$I_2 = I_1 * G_2 / (G_1 + G_2)$ = I_1 * G_2 / (G_1 + G_2) = I_2



Delta - Wye Transformation

R_1 = Resistor 1 in Wye
R_2 = Resistor 2 in Wye
R_3 = Resistor 3 in Wye
R_a = Resistor a in Delta
R_b = Resistor b in Delta
R_c = Resistor c in Delta





$R_1 = R_a * R_c / (R_a + R_b + R_c)$ = $\frac{R_a * R_c}{R_a + R_b + R_c}$ = R_1

$R_2 = R_a * R_b / (R_a + R_b + R_c)$ = $\frac{R_a * R_b}{R_a + R_b + R_c}$ = R_2

$R_3 = R_b * R_c / (R_a + R_b + R_c)$ = $\frac{R_b * R_c}{R_a + R_b + R_c}$ = R_3

$R_a = R_1 * R_2 / R_3 + R_1 + R_2$ = $\frac{R_1 * R_2}{R_3} + R_1 + R_2$ = R_a

$R_b = R_2 * R_3 / R_1 + R_2 + R_3$ = $\frac{R_2 * R_3}{R_1} + R_2 + R_3$ = R_b

$R_c = R_1 * R_3 / R_2 + R_1 + R_3$ = $\frac{R_1 * R_3}{R_2} + R_1 + R_3$ = R_c

The Electrical Engineering (DC Circuits) Formulas spreadsheet available for purchase at www.fastformulas.com includes the following electrical engineering formulas and analyses:

Area	Conductors in Parallel	Power	Shunt Resistance
Resistance	Conductors in Series	Decibels	Multiplier Resistance
Resistors in Parallel	Thermoelectric Effect	Parallel Circuits	Wheatstone Bridge
Resistors in Series	Voltage	Delta - Wye Transformation	Charging RC Series Circuit
% Conductivity	Voltage in Parallel	Norton Current	Discharging RC Series Circuit
Conductance	Voltage in Series	Thevenin Current	Charging RL Series Circuit
Conductivity	Current Divider	Transfer Resistance	Discharging RL Series Circuit
Voltage Regulation	Voltage Divider	Torque	

Hydrostatic Forces on a Dam

Moments Acting on a Gravity Dam

$M_{overturning}$ = moment (torque) applied to dam by horizontal pressure, causing it to pivot about the heel of the dam

$M_{resisting}$ = moment (torque) applied to dam by weight of dam and vertical pressure, resisting the overturning moment

R_x = horizontal component of the resultant hydrostatic force upon the dam

R_y = vertical component of the resultant hydrostatic force upon the dam

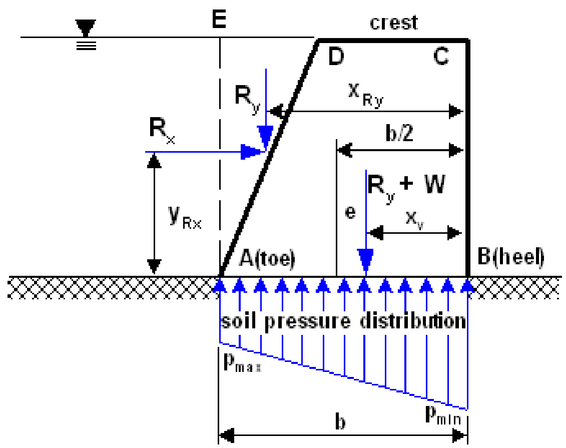
y_{Ry} = horizontal distance between the heel and the line of action of the force R_y

y_{Rx} = vertical distance between the heel and the line of action of the force R_x

W = weight of dam

x_{CG} = horizontal distance between the heel and the dam's center of gravity

$(FS)_{overturning}$ = factor of safety against overturning



Hydrostatic Forces on a Dam

$(FS)_{overturning}=M_{resisting}/M_{overturning}$ = $M_{resisting}$ / $M_{overturning}$ = $(FS)_{overturning}$

= [ ] / [ ] = [ ]

$M_{overturning}=R_x*y_{Rx}$ = R_x * y_{Rx} = F_{latch}

= [ ] * [ ] = [ ]

$M_{resisting}=(R_y*y_{Ry})+(W*x_{CG})$ = (R_y * y_{Ry}) + (W * x_{CG}) = $M_{resisting}$

= ([ ] * [ ]) + ([ ] * [ ]) = [ ]

Lateral Forces Acting on a Gravity Dam

$F_f=\mu_{static}*N$ = μ_{static} * N = F_f

= [ ] * [ ] = [ ]

F_f = frictional force

μ_{static} = coefficient of static friction

N = normal force

W = weight of the dam

$F_f=\mu_{static}*(W+R_y)$ = μ_{static} * (W + R_y) = F_f

= [ ] * ([ ] + [ ]) = [ ]

$(FS)_{sliding}$ = factor of safety against sliding
R_y = vertical component of the resultant hydrostatic force upon the dam
R_x = horizontal component of the resultant hydrostatic force upon the dam

$(FS)_{sliding}=F_f/R_x$	=	F_f	/	R_x	=	$(FS)_{sliding}$
	=		/		=	

Soil Pressures

p_{max} = maximum predicted soil pressure
p_{min} = minimum predicted soil pressure
R_y = vertical component of the resultant hydrostatic force upon the dam
W = weight of dam
b = width of dam
e = eccentricity, distance between the mid-length of the dam and the line of action fo the total vertical force ($W+R_y$)
x_v = horizontal distance from the heel to the line of action of the total vertical force ($W+R_y$)
$M_{resisting}$ = moment (torque) applied to dam by weight of dam and vertical pressure, resisting the overturning moment

$p_{max}=(R_y+W)/b*(1+6*e/b)$	= (	R_y	+	W	) /	b	* (	1	+	6	*	e	/	b	) =	p_{max}
	= (		+		) /		* (	1	+	6	*		/		) =	
$p_{min}=(Ry+W)/b*(1-6*e/b)$	= (	R_y	+	W	) /	b	* (	1	-	6	*	e	/	b	) =	p_{min}
	= (		+		) /		* (	1	-	6	*		/		) =	

$e=b/2-x_v$	=	b	/	2	-	x_v	=	e
	=		/	2	-		=	

$x_v=M_{resisting}/(R_y+W)$	=	$M_{resisting}$	/ (	R_y	+	W	) =	x_v
	=		/ (		+		) =	

Capillary Action

Height of Liquid in a Capillary Tube

$h=(4*\sigma*g_c*\cos\beta)/(\rho*d_{tube}*g)$ = (	4	*	σ	*	g_c	*	cos	(	β	)) / (	r	*	d_{tube}	*	g	) =	σ
= (	4	*		*		*	cos	(		)) / (		*		*		) =	

h = height of liquid in capillary tube (relative to liquid surface outside tube)

σ = surface tension

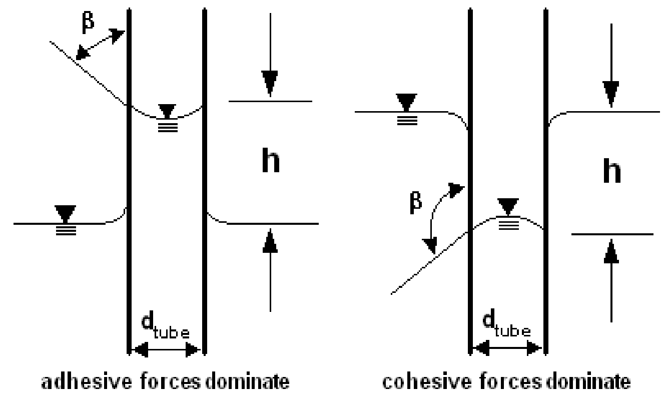
β = contact angle, in RADIANS

g_c = gravitational conversion constant: For SI, g_c=1, for English, g_c=32.174

ρ = density

d_{tube} = diameter of tube

g = gravitational acceleration



Capilarity of Liquids

Surface tension in a Capillary Tube

$\sigma=(h*\rho*d_{tube}*g)/(4*\cos\beta*g_c)$ = (	h	*	ρ	*	d_{tube}	*	g	) / (	4	*	cos	(	β	) *	g_c	) =	σ
= (		*		*		*		) / (	4	*	cos	(		) *		) =	

h = height of liquid in capillary tube (relative to liquid surface outside tube)

σ = surface tension

β = contact angle, in RADIANS

g_c = gravitational conversion constant: For SI, g_c=1, for English, g_c=32.174

ρ = density

d_{tube} = diameter of tube

g = gravitational acceleration

Radius of the Meniscus

$r_{meniscus}=d_{tube}/(2*\cos\beta)$	=	d_{tube}	/ (	2	*	cos	(	β	)) =	$r_{meniscus}$
	=		/ (	2	*	cos	(		)) =	

$r_{meniscus}$ = radius of the meniscus

d_{tube} = diameter of the tube

β = contact angle, in RADIANS