About this Guide

Thank you for downloading the PMP® Formula Study Guide. We are certain that it will be your most helpful tool in studying the formulas that are required for the PMP Exam. We wish you all the best for your PMP Exam!

This guide contains the following 3 sections

- Essential PMP formulas - The formulas you need to know for the PMP Exam.
- Values to remember - A selection of important values to study in preparation for the PMP Exam.
- Acronyms - The list of acronyms used throughout this guide as well as on the PMP Exam.

The Formula Table Explained

On the following 5 pages you will find the essential formulas that you will need to know and apply in order to pass the PMP Exam. The formulas are listed in a table with three columns. For each entry we explain the concept, list the formula(s) and explain how to interpret the result of the calculation.

Here are some explanations to help you better understand what you will find in each of the three columns:

Concept	Formula	Result Interpretation
The first column contains “The Concept” behind the formula. Instead of just giving you the formula “CV = EV - AC” we want to make sure that you understand what the formula is trying to achieve. And the best way to do that is by explaining its concept. Example: **Cost Variance (CV)** Provides cost performance of the project. Helps determine if the project is proceeding as planned.	We list the actual formula in the second column. For some concepts multiple formulas are needed, so we list them all. When helpful we also add examples for better understanding. Example: CV = EV - AC	The formula won’t do you much good if you cannot explain what the result is or means. That is why we include an interpretation in the third column. PMP questions may require interpretation. Example: Negative = over budget = bad Positive = under budget = good

Exponentiation

A number of formulas needed on the PMP exam require exponentiation. The exponent is usually shown as a superscript to the right of the base. For instance: 3^4. This exponentiation can be read as: 3 raised to the 4-th power or 3 raised to the power of 4. And 3^4 would be calculated as 3*3*3*3=81

The superscript notation 3^4 is convenient in handwriting but can lead to errors when you are in a hurry like on the PMP Exam. For instance it is very easy to forget to “raise” the exponent in a formula when you are hurriedly writing it down in the minutes before you start the exam. So it could easily happen that the formula $PV = FV / (1+r)^n$ gets written down as PV = FV / (1+r)n. The difference is minute. The result is disastrous.

Therefore, we chose to use an accepted, alternative way of expressing the exponentiation by using the **^** character.

When using this character, 3^4 is now expressed as 3^4 and $PV = FV / (1+r)^n$ is expressed as PV = FV / (1+r)^n. This removes any margin for visual errors.

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Essential PMP® Formulas

Concept	Formula	Result Interpretation
Cost Variance (CV) Provides cost performance of the project. Helps determine if the project is proceeding as planned.	CV = EV - AC	Negative = over budget = bad Positive = under budget = good
Cost Performance Index (CPI) Measure of cost efficiency on a project. Ratio of earned value to actual cost.	CPI = EV / AC	1 = good. We are getting $1 for every $1 spent. Funds are used as planned. >1 = good. We are getting >$1 for every $1 spent. Funds are used better than planned. <1 = bad. We are getting <$1 for every $1 spent. Funds are not used as planned.
Schedule Variance (SV) Provides schedule performance of the project. Helps determine if the project work is proceeding as planned.	SV = EV - PV	Negative = behind schedule = bad Positive = ahead of schedule = good
Schedule Performance Index (SPI) Measure of schedule efficiency on a project. Ratio of earned value to planned value. Used to determine if a project is behind, on or ahead of schedule. Can be used to help predict when a project will be completed.	SPI = EV / PV	1 = good. We are progressing at the originally planned rate. >1 = good. We are progressing at a faster rate than originally planned. <1 = bad. We are progressing at a slower rate than originally planned.
Estimate at Completion (EAC) Expected final and total cost of an activity or project based on project performance. Helps determine an estimate of the total costs of a project based on actual costs to date. There are many ways to calculate EAC depending on the assumptions made. (Note the *keywords* in italic.)	EAC = BAC / CPI Assumption: Use formula if *no variances* from the BAC have occurred or are expected to continue at the same rate of spending. This is the formula most often required on the exam.	Original budget modified by the cost performance. The result is a monetary value.
	EAC = AC + ETC Assumption: use formula if original estimate was *fundamentally flawed* or conditions have changed and invalidated original estimating assumptions.	Actual Cost plus a new estimate for the remaining work. Result is a monetary value.
	EAC = AC + BAC - EV Assumption: use formula if current variances are thought to be *atypical* in the future.	Actual cost to date plus remaining budget. Result is a monetary value.
	EAC = AC + ((BAC - EV) / CPI) Assumption: use formula if current variances are thought to be *typical* in the future.	Actual cost to date plus remaining budget modified by the cost performance. Result is a monetary value.
Estimate to Complete (ETC) Expected cost needed to complete all the remaining work for a scheduled activity, a group of activities or the project. Helps predict what the final cost of the project will be upon completion. There are many ways to calculate ETC depending on the assumptions made. (Note the *keywords* in italic.)	ETC = EAC - AC Inversion of the same formula from the EAC calculations. Note: This ETC formula is listed in only one (the “most famous”) PMP prep workbook. No others list it. We recommend using it, if *no keywords* are given.	Expected total cost minus actual cost to date. Result is a monetary value that will tell us how much more the project will cost.

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Concept	Formula	Result Interpretation
Estimate to Complete (ETC) Continued	ETC = BAC - EV Assumption: use formula if current variances are thought to be *atypical* in the future.	The planned budget minus the earned value. Result is a monetary value that will tell us how much more the project will cost.
	ETC = (BAC - EV) / CPI Assumption: use formula if current variances are thought to be *typical* in the future.	The planned budget minus the earned value modified by project performance. Result is a monetary value that will tell us how much more the project will cost.
	ETC = We create a new estimate when it is thought that the original estimate was *flawed*.	This is not the result of a calculation / formula, but simply a new estimate of the remaining cost.
Percent Complete How much of the planned budget do we have completed?	Percent Complete = EV / BAC * 100	The result is a percentage. What is currently completed divided by the original budget times 100.
Variance at Completion (VAC) Anticipates the difference between the originally estimated BAC and a newly calculated EAC. In other words, the cost we originally planned minus the cost that we now expect.	VAC = BAC - EAC	Result is a monetary value that estimates how much over or under budget (the variance) we will be at the end of the project. <0 = over budget 0 = on budget >0 under budget
Earned Value (EV) A quick formula for calculating the Earned Value on a project.	EV = % complete * BAC	The result is the EV, a monetary value.
Program Evaluation and Review Technique (PERT) Three point estimate for the expected duration of a schedule activity using pessimistic, optimistic and most likely durations. A probabilistic approach, using statistical estimates of durations.	(Pessimistic + (4 * Most Likely) + Optimistic) / 6	The result is the estimated duration of a schedule activity expressed as a weighted average.
PERT Standard Deviation (Single Activity) The standard deviation (σ) is a reflection of the uncertainty in the estimates. It is a good measure of the statistical variability of an activity.	σ = (Pessimistic - Optimistic) / 6	The result is the standard deviation from the mean of a schedule activity. For instance, the duration +/- 1 standard deviation will give you a 68.26% confidence that you can meet the estimated duration.
PERT Activity Variance Every activity has a variance, which is a statistical dispersion. Here is an example: The PERT three point estimate gives a 15 day duration. The variance formula tells you that you have a 2 day variance. Therefore the activity duration is 15 days +/- 2 days.	Variance = ((Pessimistic - Optimistic) / 6)^2	The Activity Variance will give you the expected variance in the activity's duration. For instance: +/- 3 days.
PERT Standard Deviation (All Activities) You may be required to calculate the duration of multiple activities and give their standard deviation. This is done by taking the square root of the total variance.	√sum((Pessimistic - Optimistic) / 6)^2 (Add up the variances of all the activities and then take the square root.)	The result is one standard deviation (or variance) from the mean of the given series of activities.
Activity Duration Determines how long an activity lasts. There are two formulas both will give the same result.	Duration = EF - ES + 1 Duration = LF - LS + 1	Number of days this activity lasts.

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Concept	Formula	Result Interpretation
Free Float Determines how many days you can delay an activity without delaying the early start of the next activity. On most sample PMP exam questions, the network diagrams are too small to show activities where free float and total float are different. In most sample questions they will be the same.	Free Float = *Earliest* ES of Following Activities - ES of Present Activity - Duration of Present Activity	Number of days this activity can be delayed without delaying the early start of the next activity. Note: If the present activity has more than one following activities, then use the *Earliest* ES of any of the following activities.
Total Float Determines how many days you can delay an activity without delaying the project. There are two formulas both will give the same result.	Total Float = LS - ES Total Float = LF – EF	Number of days this activity can be delayed without delaying the project.
Early Finish (EF) Determine when an activity will finish at the earliest.	EF = ES + duration - 1	Day on which this activity can finish earliest.
Early Start (ES) Determine when an activity can start at the earliest.	ES = EF of predecessor + 1	Day on which this activity can start earliest.
Late Finish (LF) Determine when an activity should finish at the latest.	LF = LS of successor - 1	Day on which this activity can finish latest.
Late Start (LS) Determine when an activity should start at the latest.	LS = LF - duration + 1	Day on which this activity can start latest.
Present Value (PV) Receiving money in the present (today) has a different value than receiving money in the future (in 3 years). This formula calculates how much. (Also described as value today of future cash flows.)	PV = FV / (1+r)^n	The result is the amount of money you need to invest today (PV) for n years at r % interest in order to end up with the target sum (FV). The higher the PV the better.
Future Value (FV) Receiving money in the future (in 3 years) has a different value than receiving money in the present (today). This formula calculates how much. (Also described as the discounted value of a future cash flow.)	FV = PV * (1+r)^n	The result is the amount of money you will end up with (FV) if you invest a sum of money (PV) for n years at r % interest.
Net Present Value (NPV) Method for financial evaluation of long-term projects. (Also described as Present value of cash inflow / benefits minus present value of cash outflow / costs.)	Formula not required for exam.	Positive NPV is good. Negative NPV is bad. The project with the higher NPV is the “better” project.
Return on Investment (ROI) Ratio of money gained or lost on an investment relative to the amount of money invested. The amount of money gained or lost is often referred to as interest, profit/loss, gain/loss, or net income/loss.	Formula not required for Exam	The project with the higher ROI is better and should be selected.
Internal Rate of Return (IRR) Interest rate at which the present value of the cash flows equals the initial investment. More precise and more conservative than NPV.	Formula not required for exam.	The project with the higher IRR is better and should be selected.
Payback period Rough tool to estimate the time it takes to recover the initial investment by adding up the future cash inflows until they are equal to the initial investment. (Or in plain English: The time it takes until you make a profit.)	Add up the projected cash inflow minus expenses until you reach the initial investment.	The project with the shorter payback period is better and should be selected.
Benefit Cost Ratio (BCR) Ratio that describes the cost versus benefits of a project.	Benefit / Cost	BCR < 1 is bad. BCR > 1 is good. The project with the bigger BCR is the “better” one.

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Concept	Formula	Result Interpretation
Cost Benefit Ratio (CBR) Ratio that describes the benefits versus cost of a project. This is simply the reverse of the Benefit Cost Ratio	Cost / Benefit	CBR > 1 is bad. CBR < 1 is good. The project with the lower CBR is the "better" one.
Opportunity Cost Opportunity cost is the cost incurred by choosing one option over an alternative one. Thus, opportunity cost is the cost of pursuing one choice instead of another.	Opportunity Cost = The value of the project not chosen.	For the PMP exam the opportunity cost is usually a monetary value: Project B was selected over project A, therefore the opportunity cost is the unrealized profit of project A. Note that NO calculation is required.
Communication Channels The number of communication channels on a team.	n * (n-1) / 2	Total number of communication channels among n people of a group
	n - 1	Number of communication channels that one member of the team has with everyone else on the team. I.e. you have to make this many phone calls to call everyone else.
Expected Monetary Value (EMV) Gain or loss that will result when an event occurs. Takes probability into account. For instance: If it rains we will loose $200. There is a 25% chance that it will rain, therefore the EVM is: 0.25 * $200 = $50.	Probability * Impact in currency	A monetary value that represents the expected gain or loss of an event should it come to be.
Point of Total Assumption (PTA) The point of total assumption (PTA) is a price determined by a fixed price plus incentive fee contract (FPIF) above which the seller pays the cost overrun. In addition, once the costs on an FPIF contract reach PTA, the maximum amount the buyer will pay is the ceiling price.	PTA = ((Ceiling Price - Target Price) / Buyer's Share Ratio) + Target Cost	The result is a monetary value. When reached then the seller covers all of the cost risk beyond.
Straight-line Depreciation A method that depreciates the same amount (or percent) each year by dividing the asset's cost by the number of years it is expected to be in service. The simplest of the depreciation methods.	Depreciation Expense = Asset Cost / Useful Life Depreciation Rate = 100% / Useful Life	The result is either the Depreciation Expense (the yearly depreciation amount: $200) or the Depreciation Rate (the yearly depreciation percentage: 5%).
Double Declining Balance Most common depreciation method that provides for a higher depreciation charge in the first year of an asset's life and gradually decreasing charges in subsequent years. It does this by depreciating twice the straight-line depreciation rate from an assets book value at the beginning of the year.	Depreciation Rate = 2 * (100% / Useful Life) Depreciation Expense = Depreciation Rate * Book Value at Beginning of Year Book Value = Book Value at beginning of year - Depreciation Expense	The Depreciation Rate stays the same over the years, but the Depreciation Expense gets smaller each year because it is calculated from a smaller book value each year.
Sum-of-Years' Digits Method Sum-of-Years' Digits is a depreciation method that results in a more accelerated write-off than straight line, but less than declining-balance method. Under this method annual depreciation is determined by multiplying the Depreciable Cost by a schedule of fraction based on the useful life of the asset.	Sum of the digits = Useful Life + (Useful Life - 1) + (Useful Life - 2) + etc. Depreciation rate = fraction of years left and sum of the digits (i.e. 4/15th)	Both depreciation rate and depreciation fraction get smaller over time. Example: Sum of the digits: If the useful life is 5, then it is 5 + 4 + 3 + 2 + 1 =15 Depreciation rate: 5/15th for the 1st year, 4/15th for the 2nd year, 3/15th for the 3rd year, 2/15th for the 4th year, and 1/15th for the 5th year.

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Concept	Formula	Result Interpretation
Average In mathematics, an average refers to a measure of the "middle" of a data set. The most common method is the arithmetic mean. That is why the “Average” is sometimes also and simply called the “Mean”.	The sum of all the members of the list divided by the number of items in the list. Average of 2, 4, 6 = (2 + 4 + 6) / 3 = 4	The result is a number representing the arithmetic mean.
Mean	See Average	
Median The middle value that separates the higher half from the lower half of the data set.	Arrange the values from lowest value to highest value and pick the middle one. Example: 4 is the median in 2, 4, 6 If there is an even number of values, calculate the mean of the two middle values. Example: 5 is the median in 2, 4, 6, 8 because 4 + 6 / 2 = 5	The result is a number representing the median.
Mode The most frequent value in a given data set.	Find the value in a data set that occurs most often. Example: 2 is the mode of 1, 2, 2, 3	The result is a number representing the mode.

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Values to Remember

Description	Value	Comment
1 sigma	68.26%	Also: 1 standard deviation
2 sigma	95.46%	Also: 2 standard deviations
3 sigma	99.73%	Also: 3 standard deviations
6 sigma	99.99%	Also: 6 standard deviations
Control Limits	Usually, 3 standard deviations above and below the mean	Control limits reflect the expected variation in the data.
Control Specifications	Not fix but defined by the customer	Must be looser than the control limits. Represents the customer's requirements.
Order of Magnitude estimate	-25% to +75%	
Preliminary estimate	-15% to + 50%	
Budget estimate	-10% to +25%	
Definitive estimate	-5% to +10%	
Final estimate	0%	
Float on the critical path	0 days	
Pareto Diagram	80/20	For instance: 80% of your problems are due to 20% of the causes
Time a PM spends communicating	90%	According to Harold Kerzner
Crashing a project	Crash the tasks with the least expensive crash cost first.	Only crash activities on the critical path.
Value of the inventory in a Just in Time (JIT) environment	0% (or very close to 0%.)	
Sunk Cost	A cost that has been incurred and cannot be reversed.	Sunk cost is never a factor when making project decisions.
In the USA the number -100 is the same as (100). Both indicate "minus one hundred".	(100) - 100	

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Acronyms

Acronym	Term	Description
AC	Actual Cost	AC is the total cost expended and reported during the accomplishment of a project task or project. This can be labor hours alone; direct costs alone; or all costs, including indirect costs.
BAC	Budget at Completion	The sum of all budgets allocated to a project.
BCR	Benefit Cost Ratio	Ratio that compares benefits to cost
CBR	Cost Benefit Ratio	Ratio that compares cost to benefit (Inversion of BCR)
CPI	Cost Performance Index	The CPI is a cost efficiency rating on a project, expressed as a ratio of actual cost to earned value.
CV	Cost Variance	A measure of cost performance on the project, expressed as the difference between earned value and actual cost.
EAC	Estimate at Completion	The expected total cost for scheduled activity, a group of activities, or the project when the work will be completed.
EF	Early Finish	Early finish of an activity
EMV	Expected Monetary Value	This is a statistical technique that calculates the probable financial results of events.
ES	Early Start	Early start of an activity
ETC	Estimate to Complete	ETC is the expected cost needed to complete all the remaining work for a scheduled activity, a group of activities, or the project. ETC helps project managers predict what the final cost of the project will be upon completion.
EV	Earned Value	EV is the value of completed work expressed in terms of the approved budget assigned to that work for a scheduled activity or work breakdown structure component.
FV	Future Value	Value of money on a given date in the future
IRR	Internal Rate of Return	A capital budgeting metric used by firms to decide whether they should make investments. It is an indicator of the efficiency of an investment.
LF	Late Finish	Late finish of an activity
LS	Late Start	Late start of an activity
NPV	Net Present Value	Standard method for the financial appraisal of long-term projects. Measures the excess or shortfall of cash flows, in present value (PV) terms, once financing charges are met.
PERT	Program Evaluation and Review Technique	Method that allows the estimation of the weighted average duration of tasks
PTA	Point of Total Assumption	Contract price above which the seller bears all the loss of a cost overrun.
PV	Planned Value	PV is the authorized budget assigned to the scheduled work to be accomplished for a scheduled activity or work breakdown structure component.
PV	Present Value	Value of money received today instead of in the future.
ROI	Return on Investment	Ratio of money gained or lost on an investment relative to the amount of money invested
SPI	Schedule Performance Index	Ratio of work accomplished versus work planned, for a specified time period. The SPI is an efficiency rating for work accomplishment, comparing work accomplished to what should have been accomplished.
SV	Schedule Variance	A measure of schedule performance on the project, expressed as the difference between earned value and planned value.
VAC	Variance at Completion	VAC forecasts the difference between the Budget-at-Completion and the expected total costs to be accrued over the life of the project based on current trends.
σ	Sigma	The lower case Greek letter sigma is used to denote the standard deviation.

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