| Purpose | Formula | Description |
| --- | --- | --- |
| **Calculate Beta Value in PERT (Program Evaluation and Review Technique)** | **Beta = (Pessimistic + 4 Most Likely + Optimistic) / 6** | **This equation finds the expected value by giving weightage to the most likely Value.** |
| **Calculate Estimated Monetary Value (EMV)** | **EMV = P x I** | **This is used to identify and manage risk in projects. P is the probability of an event happening and I is the impact it can have in monetary terms.** |
| **Calculate Risk Priority Number (RPN)** | **RPN = Severity x Probability x Detection** | **RPN is a value to rank risks. It is a direct multiplication of the three values.** |
| **Calculate Earned Value (EV)** | **EV = % Complete x Budget at Completion** | **Budget at Completion is the total project value. Simply put, it is the estimated cost of all the work to be completed during the project.** |
| **Calculate Cost Variance (CV)** | **CV = Earned Value – Actual Cost** | **This measures the difference between the budgeted costs and the actual costs** |

| Purpose | Formula | Description |
| --- | --- | --- |
| **Calculate Schedule Variance (SV)** | **SV = Earned Value – Planned Value** | **This checks the value of the actual work against the planned progress** |
| **Calculate Cost Performance Index (CPI)** | **CPI = Earned Value / Actual Cost** | **CPI is an indicator if the project is going as per budget** |
| **Calculate Schedule Performance Index (SPI)** | **SPI = Earned Value / Planned Value** | **The Schedule Performance Index measures how efficient the project schedule is.** |
| **Calculate Estimate at Completion (EAC)** | **EAC = Budget at Completion / Cost Performance Index**<br><br>**EAC = Actual Cost + Bottom – up Cost to Complete**<br><br>**EAC = Actual Cost + (Budget at Completion – Earned Value)**<br><br>**EAC = Actual Cost + [(Budget at Completion – Earned Value) / (Cost performance Index x Schedule Performance Index)]** | **Estimate at Completion is an indicator that forecasts the actual budget that may be needed at the current stage. It can be calculated as per any of the four methods.** |

| Purpose | Formula | Description |
| --- | --- | --- |
| **Calculate Variance at Completion** | **Variance at Completion = Budget at Completion – Estimate at Completion** | **It estimates additional budget required or a surplus that would be available at the completion of the project** |
| **Calculate Estimate to Complete (ETC)** | **TCPI = (Budget at Completion – Earned Value) / (Estimate at Completion – Actual Cost)**<br><br>**TCPI = (Budget at Completion – Earned Value) / (Budget at Completion – Actual Cost)** | **TCPI tells the project manager the cost performance that is required to complete the project.** |
| **Calculate Standard Deviation** | **Standard Deviation (σ) = (Pessimistic – Optimistic) / 6** | **Standard deviation indicates how reliable the estimated values are and how likely they are to vary during the actual project** |
| **Calculate Communication Channels** | **Communication Channels = n(n-1) / 2** | **This formula lets you understand the number of communication channels needed in a project. Here n is the number of stakeholders involved in the project** |

| Purpose | Formula | Description |
| --- | --- | --- |
| Calculate Cost plus Percentage of Cost | Cost plus Percentage of Cost = Cost + n% | I pre-decided percentage of cost is added to the actual cost |
| Calculate Cost plus Fixed Fee | Cost plus Fixed Fee = Cost + n | A pre-decided amount is added to the actual cost incurred |
| Calculate Cost plus Award Fee | Cost plus Award Fee = Cost + n | A fixed fee is added to the actual cost along with reimbursements for expenses |
| Calculate Cost plus Incentive Fee | Cost plus Incentive Fee = Cost + n | In addition to the cost an incentive is paid if the project is done within the budget or at a lower cost |
| Calculate Return on Investment (ROI) | ROI = (Net Profit / Cost of Investment) x 100 | This indicates how investment in a project is performing |
| Calculate Payback Period | Payback Period = Initial Investment / Periodic Cashflow | This refers to the time required to recover the funds invested in a project |

| Purpose | Formula | Description |
| --- | --- | --- |
| **Calculate Cost Benefit Ratio** | **Cost Benefit Ratio = Net Present Value of Investment / Initial Investment Cost** | **It is a number that measures the monetary benefits of a project against the cost involved in it** |
| **Calculate Present Value (PV)** | **PV = Future Value / (1 + i)n** | **This considers the time value for money and discounts from the future value. "i" represents the interest rate and n represents the time periods.** |
| **Calculate Future Value (FV)** | **FV = Present Value x (1 + i)n** | **Used to measure value at a future date. "i" represents the interest rate and n represents the time periods.** |
| **Calculate Target Price** | **Target Price = Target Cost + Target Fee** | **This is a price arrived by both the buyer and seller** |
| **Calculate the Point of Total Assumption** | **PTA = [(Ceiling Price — Target Price) / Buyer's Share Ratio] + Target Cost** | **This is the cost above which the seller will have to bear the additional costs incurred** |

## 1. Beta Value in PERT

Formula: Beta = (Pessimistic + 4 Most Likely + Optimistic) / 6

Beta value in PERT (Program Evaluation and Review Technique) is a weighted average taken from three values. Optimistic Value, Most Likely Value, and Pessimistic Value. Suppose a task takes 5 days to finish on average, but when things do not go according to plan it could take up to 10 days. When prioritized and everything goes according to plan it can be completed in 3 days.

3 becomes the Optimistic Value, 5 is the Most Likely Value, and 10 is the pessimistic value.

So, Beta value will be (3 + (4x5) + 10)/6

= 5.5 days.

This is also sometimes calculated without giving weightage to the most likely value

In that case the calculation will be (3+5+10)/3

= 6 days



## 2. Expected Monetary Value (EMV)

Formula: EMV = P x I

EMV or Expected Monetary Value is a concept in risk management. It is calculated by multiplying the probability of an event and the impact of it.

Let’s say that we have estimated the probability of an event to be 1/3rd or 0.33. If that event occurs it would cost, you $6000. In this instance EMV would be calculated as

6000 * 1/3 = $2000

This value will help you assess and compare the magnitude of risks and prepare for them.

### 3. Risk Priority Number

Formula: RPN = Severity x Probability x Detection

Risk Priority Number or RPN is a value that will help you rank the risks of tasks. This is calculated by multiplying three values.

Severity – denoting the severity of the risk.

Probability – denotes how likely the severity would be.

Detection - represents the ease with which it can be detected.

The rankings are done in a reverse order. For example, if there are 50 risks the one with the highest risk will be ranked 50. The one with the highest likelihood of happening will get the highest numerical value and under detection the highest number would go to the risk that is hardest to detect. The value is usually represented on a scale of 0 to 1. With a risk that has a high severity, high probability, and low chance of getting detected will have values close to 0.9 and the lower risk tasks will have values closer to 0.1.

By multiplying the three values you get the RPN. The RPN can be used to decide which task requires more focus and control from the perspective of project success or risk mitigation. The higher the value of RPN the more attention it should be given.

### 4. Earned Value

Formula: EV = % Complete x Budget at Completion

Earned Value estimates the amount of work done in terms of monetary value.

It is calculated by multiplying the percentage of work completed and the project value represented by budget at completion.

If the Budget at completion is $50,000 and 60% of the project is done, then the calculation can be made in the following way.

50,000 x 60/100

=$30,000

### 5. Cost Variance

Formula: CV = Earned Value – Actual Cost

Cost Variance measures the difference between actual cost and budgeted cost. This provides a good indicator of how your project is proceeding in terms of meeting the budget. If the actual costs are higher than the earned value, then it is a case for concern.

If Actual cost incurred is $400 and the Earned Value in $450 the Cost Variance will be

Earned Value – Actual Cost

450 – 400

= $50

### 6. Schedule Variance

Formula: SV = Earned Value – Planned Value

This is a simple calculation where the earned value is subtracted from the planned value. This value measures the actual progress against the scheduled progress.

Let's say your project is worth $20,000 and scheduled to be completed in 4 months.

At the end of two months your earned value (EV) should be at $10,000, which is also the planned or estimated value at the start of the project. If your earned value and planned value are same, then there is no schedule variance. If it is let's say at $7,500 then you would calculate Schedule Variance as

Earned Value – Planned Value

7500 – 10000

= -2500

This shows that you have a negative Schedule Variance which means that the project is running behind schedule. You can also express SV as a percentage. In the above case it would be –25%

### 7. Cost Performance Index (CPI)

Formula CPI = Earned Value / Actual Cost

The Cost Performance Index measures the cost efficiency of the project in utilizing the funds invested in it. It is calculated through dividing earned value by actual cost. A higher CPI means that you are exceeding your budget.

A CPI of greater than 1 shows a greater cost efficiency. If the Earned value is calculated at $15,000 and the Actual cost incurred is $10,000 then we would calculate CPI as

Earned Value /Actual Cost

=15000/10000 = 1.5

This denotes a high cost-efficiency in the project.

### 8. Schedule Performance Index (SPI)

SPI PMP Formula:

SPI = Earned Value/Planned value

The Schedule Performance Index measures how well the project schedule is holding up against the original project plan. If the SPI is at 1, it means you are on schedule, if it is more than 1 it means you are ahead of schedule, and an SPI value that is under 1 means you are behind schedule.

Let’s imagine you have an earned value of $7,500 and a planned value of $10,000

In this case your SPI would be calculated as

Earned Value / Planned Value

7500/10000 = 0.75

This denotes that your project is running behind schedule.

### 9. Estimate at Completion (EAC)

EAC PMP Formula:

EAC = Budget at Completion / Cost Performance Index

EAC = Actual Cost + Bottom –up Cost to Complete

EAC = Actual Cost + (Budget at Completion – Earned Value)

EAC = Actual Cost + [(Budget at Completion – Earned Value) / (Cost performance Index x Schedule Performance Index)]

Estimate at Completion is the revised estimate of the budget needed for completing the project. This may change from the original budget through additional costs or a change in prices or other unforeseen variables.

Let's assume that the budget at completion is $20000 and the CPI is at 0.75.

In this case you would calculate EAC as

Budget at Completion / Cost Performance Index

20000/0.75 = 26,667

This means that you will need an extra $6,667 to complete the project at the current level of cost efficiency.

### 10. Variance at Completion

Formula: Variance at Completion = Budget at Completion – Estimate at Completion

Variance at Completion calculates
how much the project budget is accurate to the planned budget. This will help you to plan and estimate requirements more accurately.

If the Budget at completion was $20,000 and you find that the Estimate at completion is $25,000, then you could calculate the Variance at completion by calculating:

Budget at Completion – Estimate at Completion

20000 – 25000 = -5000

You will get at Variance at Completion of –5000.  Which means the project is going beyond the initial budget by $5000

### 11. Estimate to Complete (ETC)

Formula: Estimate to Complete = Estimate at Completion – Actual Cost

Estimate to Complete or ETC is a measure of how much funds will be required to complete the remaining work. This will help you by giving a dynamic value that is more accurate than
your initial estimates.

For example, if the Estimate to complete is calculated at $25,000 and the Actual Cost incurred is $10,000. In this case you can calculate the Estimate to Complete as follows.

Estimate at Completion – Actual Cost

25000 – 10000

=$15,000

This means that you will need $15,000 at this point to successfully complete the project.

### 12. To Complete Performance Index (TCPI)

Formula:

TCPI = (Budget at Completion – Earned Value) / (Estimate at Completion – Actual Cost)

TCPI = (Budget at Completion – Earned Value) / (Budget at Completion – Actual Cost)

To Complete Performance Index (TCPI) gives the cost performance required to meet project goals based on the budget that is available. If the Budget at completion is $20,000, Estimate at Completion is $25,000, Earned Value is at $10,000 and Actual Cost is at $ 12,000. In this situation we would calculate TCPI as (Budget at Completion – Earned Value) / (Estimate at Completion – Actual Cost)

(20000-10000)/ (25000-12000)

= 10000/13000 = 0.77

The TCPI would be at 0.77

### 13. Standard Deviation

Formula: Standard Deviation (σ) = (Pessimistic – Optimistic) / 6

Standard Deviation expressed by the character ‘σ’ represents the degree to which the values can change within a project. Let's imagine a task that takes 4 days to complete in the best case and 16 days to complete in the worst case. You would calculate
standard deviation as

(Pessimistic – Optimistic) / 6

(16-4)/6

Standard deviation would be 2 in this case.

### 14. Communication Channels

Formula: Communication Channels = n(n-1) / 2

In a project, communication is key. This formula is used to measure the number of communication channels needed in a project. Here ‘n’ represents the number of stakeholders. If there are 12 stakeholders in the project, there will be communication channels between each stakeholder. If you are a stakeholder then you will be part of 11 communication channels. Similarly, every other stakeholder will be a part of 11 channels. This is the n-1 calculation. This number needs to be divided in two to remove the duplicate channels because your channel with a particular stakeholder and their channel with you should not be counted twice. In this scenario of 12 stakeholders the calculation will be as follows:

= n(n-1) / 2

12 (12-1)/2 = 66

We have 66 Communication channels in this case.

**15. Cost plus Percentage of Cost**

Formula: Cost plus Percentage of Cost = Cost + n%

This is a type of contract that is in the sellers' favor where the buyer agrees to pay all the costs incurred by the seller and adds a percentage of the total cost as payment. ‘n’ represents the agreed percentage that will be paid on top of the cost incurred. If n is 10% and the cost is 50. In this case the cost-plus percentage of cost will be calculated as:

Cost + n%

50 + (50 x 10/100)

=55

In this the cost the buyer pays more when there is an increase in the cost incurred. If the cost increases to 60 the buyer will need to pay 66.

**16. Cost plus Fixed Fee**

Formula: Cost plus Fixed Fee = Cost + n

This is done in a contract where the buyer agrees to pay all the costs plus a pre-decided amount to the seller. ‘n’ stands for the fixed amount that is to be paid apart from the costs. With the cost at 50 and ‘n’ at 5 that calculation will be a simple addition.

Cost + n

= 50 + 5

While the buyer pays 55, if the cost increases to 70, the buyer will pay 75.

**17. Cost plus Award Fee**

Formula: Cost plus Award Fee = Cost + n

In this method the seller does get paid for the cost incurred with the addition of a fixed fee called an award fee. This is a more dynamic type of scenario where n is calculated based on pre decided guidelines. If the Cost is 50 and ‘n’ is 8, then the Cost-plus award fee would be

Cost + n

50 + 8

The buyer pays 58 in this scenario.

**18. Cost plus Incentive Fee**

Formula: Cost plus Incentive Fee = Cost + n

This is like the cost-plus award fee model; the key difference is that the incentive is paid only when the project is completed within the estimated period. In this model the magnitude of incentive will depend on the speed with which the project gets completed. This is also a scenario where 'n' depends on how quickly the project got completed. The incentive might be 8 if the project is finished within 8 weeks. For 8 to 10 weeks the incentive drops to 4. For more than 10 weeks there is no incentive. If the cost is 50 and the project is finished in 9 weeks, then the Cost-plus incentive fee would be.

Cost + n

=50 + 4

The buyer pays 54 in this case, if the cost remains constant and the project is completed in 11 weeks the buyer pays only 50.

**19. Return on Investment (ROI)**

Formula: ROI = (Net Profit / Cost of Investment) x 100

Return on Investment is the measurement of the rate at which the amount invested in a project gets recovered. This is expressed as a percentage. If net profit is $2000 and the Cost of Investment is $,30,000 then we would calculate ROI as

(Net Profit / Cost of Investment) x 100

(2000/30000) x 100 = 6.67

For this project you have a ROI of 6.67%

**20. Payback Period**

Formula: Payback Period = Initial Investment / Periodic Cashflow

The Payback Period refers to the amount of time it would take to recover the investment in a project. This is again a simple calculation where if the Initial investment is $20,000 and the periodic cash flow per month is $1000, then you could calculate the Payback period as follows:

Initial Investment / Periodic Cashflow

20000/1000 = 20

Payback period in this case would be 20 months

**21. Cost Benefit Ratio**

Formula: Cost Benefit Ratio = Net Present Value of Investment / Initial Investment Cost

Cost-benefit ratio is a comparison between the funds invested in the project and the value that has come out of it. This is a measure of project success in financial terms. If the initial investment was $20,000 and the Net Present Value is $25,000 then the Cost Benefit Ratio could be calculated as follows.

Net Present Value of Investment / Initial Investment Cost

25000/20000 = 1.25

The Cost benefit ratio of 1.25 denotes that every dollar invested in the project is now worth 1.25 dollars.

**22. Present Value (PV)**

Formula: PV = Future Value / (1 + i)n

Present Value (PV) considers the time value of money. This is useful to calculate what a future amount of money would mean today if adjusted for time. ‘i’ represents the interest rate or the discounting

rate. ‘n’ represents the number of time periods. The period used should be the same for both variables. If the interest rate is 10% and the time period is 5 years. A Future Value of $20,000 will have a Present Value as calculated below

Future Value / (1 + i)n

20000/ (1+ 10%) 5

12418.43

This means a future value of $20,000 in 5 years has a present value of $12,418 as of now.

**23. Future Value (FV)**

Formula: FV = Present Value x (1 + i)n

Future Value is an estimate of what a fixed amount of money would be valued at a given point of time in the future. ‘i’ is the interest rate and ‘n’ is the number of time periods. If Present value is $20,000, ‘i’ is 10% and time period is 5 years. Then we can calculate the Future value as

Present Value x (1 + i)n

20000 x (1+0.1)5

=32210.2

The Future Value of $20,000 in 5 years if the interest rate is at 10 percent will be $32,210

**24. Target Price**

Formula: Target Price = Target Cost + Target Fee

This is a simple addition of estimated cost and an agreed fee that is given to the seller on top of the target cost. This is useful when calculating price per unit. If Target Cost is $100 and Target fee is $20 the Target price will be Target Cost + Target Fee

100 + 20

In this case we get a Target price of $120

**25. Point of Total Assumption**

Formula: PTA = [(Ceiling Price — Target Price) / Buyer's Share Ratio] + Target Cost

Point of Total Assumption is the point at which the seller has incurred costs that have stopped the project from being profitable. Any expense beyond the PTA is an additional expense incurred by the seller.  If Ceiling Price is $25, Target Price is $20, Buyer's share ratio is 5 and Target cost is $15 then we could calculate PTA as follows

[(Ceiling Price — Target Price) / Buyer's Share Ratio] + Target Cost

[[25-20)/5] +15