

Earned value

PV, EV and AC are planned value, earned value and actual cost; BAC is the budget at completion. Each formula has a worked example on one illustrative project; the two model sheets follow. They serve IPMA, PMI and APM exams alike; for APM's PMQ exam, know what each measure tells you and how it refines a budget.

FORMULAS

Schedule and cost variance (SV, CV); schedule and cost performance index (SPI, CPI)

$$\text{SV} = \text{EV} - \text{PV} \cdot \text{CV} = \text{EV} - \text{AC} \cdot \text{SPI} = \text{EV} \div \text{PV} \cdot \text{CPI} = \text{EV} \div \text{AC}$$

Variances are gaps in money; indices are efficiency. Below 0 or below 1.0: behind schedule, or over budget. EV comes first.

Example: A project with PV €450k, EV €360k, AC €400k: $\text{SV} = 360 - 450 = -€90\text{k}$; $\text{CV} = 360 - 400 = -€40\text{k}$; $\text{SPI} = 360 \div 450 = 0.80$; $\text{CPI} = 360 \div 400 = 0.90$

Estimate at completion (EAC): the default

$$\text{EAC} = \text{BAC} \div \text{CPI, if the cost efficiency so far continues}$$

Why it works: at the same efficiency, the work left costs $(\text{BAC} - \text{EV}) \div \text{CPI}$. Since $\text{AC} = \text{EV} \div \text{CPI}$, $\text{AC} + (\text{BAC} - \text{EV}) \div \text{CPI} = \text{BAC} \div \text{CPI}$.

Example: BAC €900k, EV €360k, AC €400k, CPI 0.90: $400 + 540 \div 0.9 = 400 + 600 = €1,000\text{k}$, the same as $900 \div 0.9$

EAC under other assumptions

$$\text{AC} + (\text{BAC} - \text{EV}) \cdot \text{AC} + (\text{BAC} - \text{EV}) \div (\text{CPI} \times \text{SPI}) \cdot \text{AC} + \text{a new estimate of the rest}$$

In turn: the rest goes as planned (a one-off overrun); a fixed date also drives cost; the plan no longer holds, so re-estimate the rest. Say which, and why.

Example: BAC €900k, EV €360k, AC €400k, CPI 0.90, SPI 0.80: $400 + 540 = €940\text{k}$; $400 + 540 \div (0.90 \times 0.80) = 400 + 750 = €1,150\text{k}$; the third needs a new bottom-up estimate

Estimate to complete (ETC) and variance at completion (VAC)

$$\text{ETC} = \text{EAC} - \text{AC} \cdot \text{VAC} = \text{BAC} - \text{EAC}$$

ETC is the money still needed; VAC is the expected overrun (negative) or saving. Compare VAC with the reserves.

Example: BAC €900k, AC €400k, EAC €1,000k: $\text{ETC} = 1,000 - 400 = €600\text{k}$; $\text{VAC} = 900 - 1,000 = -€100\text{k}$

To-complete performance index (TCPI)

$$\text{TCPI} = (\text{BAC} - \text{EV}) \div (\text{BAC} - \text{AC}), \text{ or } \div (\text{EAC} - \text{AC}) \text{ once a new EAC is approved}$$

The cost efficiency the remaining work needs to meet the target. Well above the CPI so far: say that recovery is unlikely.

Example: BAC €900k, EV €360k, AC €400k: $540 \div 500 = 1.08$, against a CPI of 0.90 so far

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Earned value formulas

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Sources: IPMA ICB4 (2015); PMI, PMBOK® Guide, 8th ed.; PMI, PMP® Examination Content Outline (2026); APM Body of Knowledge, 8th ed.; APM, PMQ handbook (v6, 2026); IPMA International Certification Regulations (ICR) v4.4 (2025); Lipke (2003), earned schedule; Morris, Reconstructing Project Management (2013)

Key: IPMA = International Project Management Association; ICB4 = IPMA's Individual Competence Baseline; PMI = Project Management Institute; PMBOK® Guide = PMI's body-of-knowledge guide; PMP® = PMI's Project Management Professional; APM = Association for Project Management; PMQ = APM's Project Management Qualification; ICR = IPMA's International Certification Regulations. Unofficial study material for IPMA®, PMI® and APM exams. Not affiliated with, endorsed by or approved by IPMA, PMI or APM, and not an accredited or endorsed training provider. IPMA® and IPMA ICB® are registered trademarks of IPMA in Switzerland and other countries. PMI, PMP, CAPM and PMBOK are registered marks of Project Management Institute, Inc. APM is a trade mark of the Association for Project Management. Other marks belong to their owners. PMP® exam facts are from PMI's public PMP® Examination Content Outline (2026); check the current version on pmi.org. APM's qualifications are its own; this series is not an APM Accredited Provider or APM Endorsed. Examples use a fictional city and its projects.

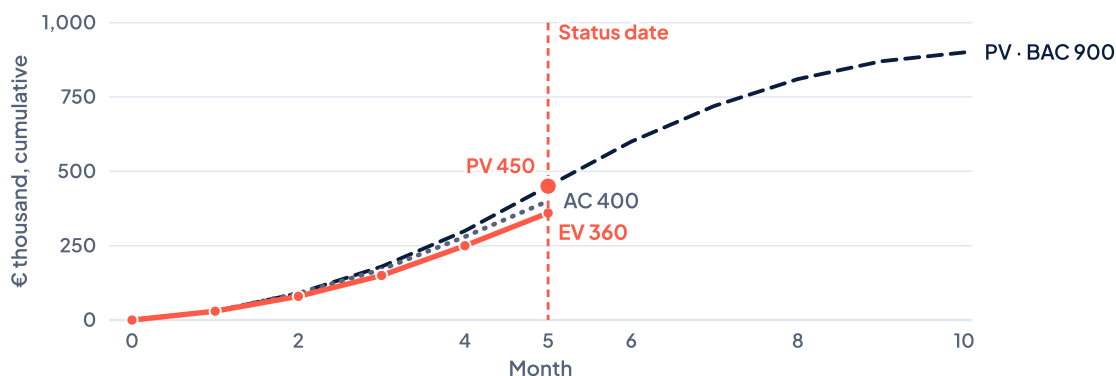


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Earned value: the three curves

See on one chart whether the work is on time and on budget, by comparing planned value, earned value and actual cost.



Illustrative: a ten-month project. End of month 5: PV 450, EV 360, AC 400. SV -90, CV -40; SPI 0.80, CPI 0.90.

WHAT IT IS

Earned value measures progress in money. **Planned value (PV)**: work due by the status date, priced at budget. **Earned value (EV)**: work finished, priced likewise. **Actual cost (AC)**: what it cost. PV ends at the budget at completion (BAC); the method comes from US defence projects of the 1960s (Morris, 2013).

HOW IT WORKS

- 01 Time-phase the budget: the PV curve, ending at the BAC.
- 02 Agree credit rules: e.g. half at start, half at finish.
- 03 Each status date: EV, and AC on the budget's basis.
- 04 Schedule: $SV = EV - PV$, $SPI = EV \div PV$. Below 0 or 1: late.
- 05 Cost: $CV = EV - AC$, $CPI = EV \div AC$. Below 0 or 1: over.

MID-LEVEL · WORKED EXAMPLE

Apply it well

The situation: A city team has eight months to move resident parking permits online, with €576k of budgeted work. End of month 4: PV €360k, EV €288k, AC €300k.

$SV = 288 - 360 = -€72k$, $SPI = 288 \div 360 = 0.80$; $CV = 288 - 300 = -€12k$, $CPI = 288 \div 300 = 0.96$. Causes: late supplier integrations and extra staff hours.

In the exam: Define PV, EV and AC, work out both variances and indices, and say what they mean.

SENIOR · WORKED EXAMPLE

Design and lead it

The situation: A city is joining 14 online services under one login over 30 months, with two main suppliers; €11.5m of planned work is baselined phase by phase.

The baseline splits by service. Suppliers earn value only at accepted milestones, AC has a monthly cut-off, and the board sees variances beyond threshold.

In the exam: Explain the design: the baseline, who measures, the credit and AC rules, and what reaches the board.

WHERE IT SITS

IPMA · ICB4	PMI · PMBOK® GUIDE 8 · PMP® EXAM	APM · BOK 8 · PMQ EXAM
4.5.10: earned value analysis as a skill (p. 137); 4.5.7.5: SPI and CPI as indicators (pp. 126–127)	Guide pp. 169–170: PV, EV and AC; story points in adaptive work. Exam outline: Process task 9	BoK (APM's Body of Knowledge) §5.5.4: earned value analysis (EVA), measured against the deployment baseline. PMQ (APM's Project Management Qualification) 22b

Sources: IPMA ICB4 (2015); PMI, PMBOK® Guide, 8th ed.; PMI, PMP® Examination Content Outline (2026); APM Body of Knowledge, 8th ed.; APM, PMQ handbook (v6, 2026); Morris, Reconstructing Project Management (2013)

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Earned value formulas

Turn PV, EV and AC into variances, indices and a forecast of the final cost, and state the assumption behind each forecast.

MEASURE	FORMULA	EXAMPLE	READS
Schedule	$SV = EV - PV \cdot SPI = EV \div PV$	$-90 \cdot 0.80$	80% of the planned work done
Cost	$CV = EV - AC \cdot CPI = EV \div AC$	$-40 \cdot 0.90$	90 cents of work per euro
Final cost	$EAC = BAC \div CPI$	$900 \div 0.9 = 1,000$	If the efficiency so far continues
To spend · gap	$ETC = EAC - AC \cdot VAC = BAC - EAC$	$600 \cdot -100$	€100k over the budget
Needed from now	$TCPI = (BAC - EV) \div (BAC - AC)$	$540 \div 500 = 1.08$	Each euro must buy €1.08 of work

Illustrative, € thousand: BAC 900, PV 450, EV 360, AC 400. Other EACs: 940 (rest as planned), 1,150 (CPI × SPI).

WHAT IT IS

PV, EV and AC are planned value, earned value and actual cost; BAC, the budget at completion. Variances (SV, CV) are gaps in money; indices (SPI, CPI), efficiency, with 1.0 on plan. The **estimate at completion (EAC)** forecasts the final cost: four common formulas, one per assumption (PMBOK® Guide, PMI's body-of-knowledge guide.). Then come the **estimate to complete (ETC)**, the **variance at completion (VAC)** and the **to-complete performance index (TCPI)**.

HOW IT WORKS

- 01 Efficiency continues: $EAC = BAC \div CPI$ (as $AC = EV \div CPI$).
- 02 Rest as planned (one-off overrun): $EAC = AC + (BAC - EV)$.
- 03 Date also drives cost: $EAC = AC + (BAC - EV) \div (CPI \times SPI)$.
- 04 Plan no longer holds: $EAC = AC + \text{a bottom-up estimate}$.
- 05 Then $ETC = EAC - AC$, $VAC = BAC - EAC$; TCPI: the efficiency the rest needs.

MID-LEVEL · WORKED EXAMPLE

Apply it well

The situation: A city team has eight months to move resident parking permits online. BAC = €576k of work; a €24k contingency sits above it, outside BAC. End of month 4: PV €360k, EV €288k, AC €300k.

$EAC = 576 \div 0.96 = €600k$, so $VAC = -€24k$: the whole contingency. The project manager states this assumption and the range: €588k ($300 + 288$, rest as planned) to €675k ($300 + 288 \div (0.96 \times 0.80)$, $CPI \times SPI$).

In the exam: Show each formula with its numbers, pick one EAC and say why, and say what VAC means for the reserves.

SENIOR · WORKED EXAMPLE

Design and lead it

The situation: A city is joining 14 online services under one login over 30 months. The core platform is fixed price, and the project manager holds a €1.2m contingency.

Under the fixed price, the city cannot see the supplier's real costs. So the project manager builds a bottom-up estimate to complete, cross-checks it with the formulas, and brings the board a range, the causes and options.

In the exam: Test the formulas against the contracts and the schedule; give a range, tie it to the reserves, show who decides.

WHERE IT SITS

IPMA · ICB4	PMI · PMBOK® GUIDE 8 · PMP® EXAM	APM · BOK 8 · PMQ EXAM
4.5.7.4–4.5.7.5 (pp. 126–127): earned value indicators, forecasts, signalling cost breaches	Guide: TCPI p. 206; four EACs, pp. 207–210. Exam outline: Process task 6, Plan and manage finance	BoK (APM's Body of Knowledge) §5.8.2 Cost control: a revised forecast if an overspend cannot be recovered. PMQ (APM's Project Management Qualification) objective 22b

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