

GAM · Optimal Order Quantity — Strategy & Tricks

One square root, five one-liners, and the six slips the wrong options are built to catch.

Contents: One formula, five cousins · Sort it in five seconds · Label the givens, then move · Roots without a calculator · The 90-second budget · Six ways to lose a free mark · Worked examples, easy to hard · Recognition drills · Guided walk-through: one passage, four questions · Progressive practice · Speed training · Exam application · Cheat sheet

One formula, five cousins

Order too often and you drown in paperwork; order too rarely and you drown in stock. The Economic Order Quantity is the lot size where the annual ordering bill equals the annual holding bill — the point where their sum is smallest. Everything here flows from it and a few one-liners.

Exam facts About 60 questions in 90 minutes — roughly **90 seconds each** — one passage shared by four or five questions, four options, **no negative marking**. Never leave a blank. No calculator; the passage states the model it wants.

$Q^* = \sqrt{(2DS \div H)}$ — optimal order size

$N = D \div Q$ — orders per year

Ordering cost = $(D \div Q) \times S$

Holding cost = $(Q \div 2) \times H$ — average stock is $Q \div 2$

At Q^* : ordering cost = holding cost

$TC^* = \sqrt{(2DSH)} = Q^* \times H$ — minimum relevant cost

$d = D \div \text{working days}$ (360, 250 or 365 — as stated)

$ROP = d \times L$ (+ safety stock SS)

Cycle = $Q \div d = \text{working days} \div N$

D annual demand · S per order · H per unit-year · Q order size · N orders a year · d daily demand · L lead time · SS safety stock. Passages may say A, O, C.

Not in the kit: the purchase price. With a fixed unit price the annual purchase bill is fixed too, so it cannot move Q . *It enters only with a quantity discount, where you compare full* annual cost at each break.*

Why a square root Ordering cost $(D \div Q) \times S$ falls as Q grows; holding cost $(Q \div 2) \times H$ rises. The sum bottoms out where they meet, and setting them equal gives $Q^2 = 2DS \div H$ — so at the optimum one cost gives you both.

Sort it in five seconds

Every question here is one of six jobs. Name the job before you touch a number.

Job	Sounds like	Do this	Budget
Compute Q^*	'the EOQ is...'	$\sqrt{(2DS \div H)}$; make the inside a perfect square	40–50 s
Cost at a given Q	'orders 1,500 at a time'	That Q : $(D \div Q) \times S$ and $(Q \div 2) \times H$ separately	45–60 s

Job	Sounds like	Do this	Budget
Timing	'reorder point', 'days between orders'	d first; then $d \times L + SS$, or $\text{days} \div N$	45–60 s
Proportional change	'D rises 44%, H falls 36%'	Ratio inside the root, never a fresh sum	30–45 s
Reverse-engineer	'the reported EOQ is 1,200'	Square it: $S = HQ^2 \div 2D$, $H = 2DS \div Q^2$, $D = HQ^2 \div 2S$	50–60 s
Compare policies	'Q = 600 or Q = 1,000?'	Relevant cost at each; the curve is flat near Q^*	70–90 s

Optimal means the costs are equal, so do one. A Q handed to you means do both.

Linked questions share the passage With Q^* , N and d in hand, every other question in the set is one multiplication: the first is expensive, the rest are the reward.

Label the givens, then move

Before any formula, write six labels in the margin and fill in what the passage gives. A blank is information too — it tells you which variant you're in.

1. **D** — demand per *year*: 1,500 a month $\rightarrow$ 18,000; a 900-unit lot lasting 3 months $\rightarrow$ 3,600.
2. **S** — cost per order, not a year's worth.
3. **H** — holding cost per unit *per year*. A percentage of price? Multiply: 10% of 40 = 4.
4. **Q** — is one given? Yes: cost that Q. No: compute $Q^* = \sqrt{(2DS \div H)}$.
5. **L, SS, days** — lead time, safety stock, working-day year (360, 250 or 365).
6. Write $N = D \div Q$ and $d = D \div \text{days beside } Q$; later questions are then one line.
7. Answer exactly what was asked — Q^* , one cost, N, days, ROP — then stop.

A workshop uses 500 units a month. An order costs 30, and holding a unit for a year costs 10% of its 40 price. Deliveries arrive 6 working days after ordering; the shop works 250 days a year and keeps 150 units in reserve. Use $Q^* = \sqrt{(2DS \div H)}$ and $ROP = d \times L + SS$.

Labelled: $D = 6,000 \cdot S = 30 \cdot H = 4 \cdot L = 6 \cdot SS = 150 \cdot 250$ days.

Labelling buys the whole set: $Q^* = \sqrt{(2 \times 6,000 \times 30 \div 4)} = \sqrt{90,000} = 300$; $N = 20$; $d = 24$; $ROP = 24 \times 6 + 150 = 294$; cycle = $300 \div 24 = 12.5$ days.

In a table, each row is its own EOQ: take the row the stem names and read units off the headings.

Item	D (units/year)	S (per order)	H (per unit-year)
P-10	9,000	20	4
P-20	18,000	30	3
P-30	24,000	50	3

Roots without a calculator

No calculator, and the setters know it: the number under the root is nearly always a perfect square in disguise.

- **Cancel before you multiply.** For $2 \times 18,000 \times 30 \div 3$, do $30 \div 3 = 10$ first, then $2 \times 18,000 \times 10 = 360,000$ — never build 1,080,000 and divide.
- **Strip zeros in pairs.** $\sqrt{360,000} = 6 \times 100 = 600$; $\sqrt{1,440,000} = 12 \times 100 = 1,200$. Odd zeros mean a slip — or an 'approximately' question: $\sqrt{2} \approx 1.41$, $\sqrt{5} \approx 2.24$.
- **Scale, don't recompute.** $Q \propto \sqrt{D}$, $\sqrt{S}$ and $1 \div \sqrt{H}$: $D \times 4 \rightarrow Q \times 2$; $H \times 4 \rightarrow Q^* \div 2$; $D +44\% \rightarrow \times 1.2$; $S -36\% \rightarrow \times 0.8$; D and H both doubled $\rightarrow$ unchanged.
- **At the optimum, one cost is enough.** Holding is $(Q \div 2) \times H$, *ordering the same, the total double — or straight to $TC = Q^* \times H$.*
- **Days between orders = working days $\div$ N.** 360 days, 20 orders $\rightarrow$ 18 days. Q never enters.
- **Penalty for a wrong lot.** $TC(Q) \div TC = 0.5 \times (Q \div Q + Q^* \div Q)$: half or double the EOQ costs exactly 25% more, 20% under costs 2.5%. That flat bottom makes 'nearest feasible lot' questions safe.

Perfect-square radar $11^2 = 121$, $12^2 = 144$, $13^2 = 169$, $14^2 = 196$, $15^2 = 225$, $16^2 = 256$, $25^2 = 625$ — and the percentage versions 1.21, 1.44, 1.69, 0.49, 0.64, 0.81. See one, the root is instant.

The 90-second budget

Ninety seconds is the average, not the ration: a five-question set gets about seven minutes, front-loaded.

Phase	Seconds	What happens
Read and label	20–25	Six labels; months to years, percentages to H.
First question (usually Q^*)	30–40	Cancel, root, pick; write Q^* , N and d down.
Each linked question	20–40	One multiplication or one ratio.
Sanity check	5	Costs at Q <i>equal?</i> <i>ROP below</i> Q ? $N \times Q \approx D$?

- **Read the options first.** A spread like 173, 232, 600, 2,683 names the slips on offer; the clean number is usually the answer.
- **Never total when a component is asked**, and never do both components at Q^* — they're equal.
- **Round late.** Carry 848.5 to the last line; options sit far enough apart that ± 1 never matters.

When the root won't resolve $\sqrt{800,000}$ sits between $800^2 = 640,000$ and $900^2 = 810,000$, close to the top — about 894. Bracket it, take the nearest option, move on.

That is the exact-versus-estimate line: a clean square is exact, anything else you bracket.

Six ways to lose a free mark

Nothing here is hard; everything is easy to get wrong at speed, and each trap has an option waiting.

1. **A given Q is not optimal.** 'Orders 1,000 at a time' does not equalise the costs — do both; the trap option doubles one.
2. **Per unit-month vs per unit-year.** 0.50 a month becomes 6 a year. '15% of unit price' means multiply, not plug in 0.15.
3. **Monthly demand under the root.** The answer lands $\sqrt{12} \approx 3.5$ times too small — always an option.
4. **Units vs orders.** Q is units; $N = D \div Q$ is orders — the commonest mis-read here.

5. **Safety stock forgotten — or added twice.** $ROP = d \times L + SS$, once; average stock with a reserve is $Q \div 2 + SS$, once.
6. **The wrong year.** Daily demand uses the year the passage states; switch it and every ROP option looks plausible.

What to avoid Don't improve the passage's conventions. If it says 360 days, use 360. The options were written from the setter's assumption, not yours.

Worked examples, easy to hard

Six passages built like real items — cover the steps, then compare.

Straight EOQ EASY · target 45s

The optimal order quantity is:

A wholesaler sells 9,000 cartons a year at a steady rate. An order costs 20; holding a carton for a year costs 4. Use $Q^* = \sqrt{(2DS \div H)}$.

- A. 212 cartons
- B. 300 cartons
- C. 600 cartons
- D. 1,200 cartons

Steps

1. Label: $D = 9,000$, $S = 20$, $H = 4$. No Q given, so compute Q^* .
2. Cancel: $2 \times 20 \div 4 = 10$, so $2DS \div H = 9,000 \times 10 = 90,000$.
3. $\sqrt{90,000} = \sqrt{9} \times \sqrt{10,000} = 3 \times 100 = 300$.
4. Traps: 212 = $\sqrt{45,000}$ (the 2 dropped); 600 doubles it; 1,200 multiplies by H .

Answer: 300 cartons

Orders and cycle length EASY · target 60s

At the EOQ, how many days pass between consecutive orders?

A garden centre uses 8,000 bags of compost a year over a 360-day trading year, orders evenly spaced. Ordering costs 40; holding 4 per bag a year. Use $Q^* = \sqrt{(2DS \div H)}$.

- A. 9 days
- B. 18 days
- C. 20 days
- D. 36 days

Steps

1. Label: $D = 8,000$, $S = 40$, $H = 4$, year = 360 days.
2. $Q^* = \sqrt{(2 \times 8,000 \times 40 \div 4)} = \sqrt{160,000} = 400$ bags, so $N = 8,000 \div 400 = 20$ orders and the cycle is $360 \div 20 = 18$ days.
3. Check: $d \approx 22.2$ a day, and $400 \div 22.2 \approx 18$.
4. Traps: 20 is the order count; 9 means lots of 200, 36 lots of 800.

Answer: 18 days

Cost at a lot size that isn't optimal MEDIUM · target 75s

The total relevant annual inventory cost of this policy is:

A distributor needs 24,000 units a year. Ordering costs 50 per order, holding 3 per unit-year; total relevant annual cost is $(D \div Q) \times S + (Q \div 2) \times H$. For handling reasons it orders lots of 1,000.

- A. 2,400
- B. 2,700
- C. 3,000
- D. 4,200

Steps

1. Label: $D = 24,000$, $S = 50$, $H = 3$, $Q = 1,000$ — given, so the two costs will not be equal.
2. Ordering: $(24,000 \div 1,000) \times 50 = 24 \times 50 = 1,200$.
3. Holding: $(1,000 \div 2) \times 3 = 500 \times 3 = 1,500$.
4. Total = $1,200 + 1,500 = 2,700$.
5. Traps: 2,400 and 3,000 double one component, as if Q were optimal; 4,200 forgets the $\div 2$.

Answer: 2,700

Monthly demand and a percentage holding cost MEDIUM · target 75s

The economic order quantity is closest to:

A retailer sells 1,500 units a month. The unit costs 20, and holding cost is 15% of unit cost per year. An order costs 30 to place. Use $Q^* = \sqrt{(2DS \div H)}$, with D the annual demand.

- A. 173 units
- B. 232 units
- C. 600 units
- D. 2,683 units

Steps

1. Convert: $D = 1,500 \times 12 = 18,000$ a year; $H = 15\% \times 20 = 3$ per unit-year; $S = 30$.
2. Cancel: $2 \times 30 \div 3 = 20$, so $2DS \div H = 18,000 \times 20 = 360,000$.
3. $\sqrt{360,000} = 6 \times 100 = 600$.
4. Traps: 173 uses monthly demand, 232 the price 20 as H , 2,683 the bare 0.15.

Answer: 600 units

Two things change at once HARD · target 60s

The new EOQ is:

Under $Q^* = \sqrt{(2DS \div H)}$, a distributor's EOQ is 1,200 units on annual demand of 36,000 units and holding cost 5 per unit-year. Demand is forecast to rise 44% and holding cost to fall 36%. Ordering cost is unchanged.

- A. 1,440 units
- B. 1,500 units
- C. 1,800 units
- D. 2,700 units

Steps

1. You never need S. Q scales with $\sqrt{(D \div H)}$, so new $Q = 1,200 \times \sqrt{(1.44 \div 0.64)}$.
2. $\sqrt{1.44} = 1.2$ and $\sqrt{0.64} = 0.8$; $1.2 \div 0.8 = 1.5$, so $1,200 \times 1.5 = 1,800$.
3. Check: $S = HQ^2 \div 2D = 100$; then $D = 51,840$ and $H = 3.2$ give $2DS \div H = 3,240,000$, root 1,800.
4. Traps: 1,440 is the demand factor alone, 1,500 the holding factor alone, 2,700 skips the root.

Answer: 1,800 units

Forced lot sizes and the penalty HARD · target 90s

Comparing the two feasible lots with the theoretical minimum cost:

A factory uses 20,000 components a year. An order costs 100; holding one component for a year costs 4. Relevant annual cost is $(D \div Q) \times S + (Q \div 2) \times H$, minimised at $Q^* = \sqrt{(2DS \div H)}$. The supplier ships only lots of 500 or 2,000.

- A. 500 is cheaper, 25% above the minimum
- B. 2,000 is cheaper, 25% above the minimum
- C. Both the same, 25% above the minimum
- D. Both the same, 12.5% above the minimum

Steps

1. $Q = \sqrt{(2 \times 20,000 \times 100 \div 4)} = \sqrt{1,000,000} = 1,000$, so $TC = Q^* \times H = 4,000$.
2. $Q = 500$: ordering $40 \times 100 = 4,000$, holding $250 \times 4 = 1,000$, total 5,000.
3. $Q = 2,000$: ordering $10 \times 100 = 1,000$, holding $1,000 \times 4 = 4,000$, total 5,000.
4. Both give $5,000 \div 4,000 = 1.25$ — the 25% the ratio rule predicts at half or double the EOQ. A tie, so any 'cheaper' option is out; 12.5% is that halved.

Answer: Both the same, 25% above the minimum

Recognition drills

Recognition is the speed, not arithmetic. Say each answer out loud before the seconds run out.

Which line of the kit?

Name the formula, not the number.

1. 'How many orders per year at the EOQ?' (5s)

Answer: $N = D \div Q^*$

2. 'Average cycle inventory for lots of 900?' (5s)
Answer: $Q \div 2 = 450$ — the given Q, not Q^*
3. 'At what stock level does a new order go out?' (6s)
Answer: $ROP = d \times L + SS$
4. 'Minimum total relevant annual cost?' (6s)
Answer: $\sqrt{(2DSH)}$, or $Q^* \times H$
5. 'Using a 250-day year, time between orders?' (6s)
Answer: $250 \div N$ (or $Q \div d$)
6. 'Reported EOQ 800; the implied ordering cost?' (8s)
Answer: $S = H \times Q^2 \div 2D$
7. '2% off for lots of 2,000 or more — switch?' (8s)
Answer: Full annual cost at 2,000 vs at Q^*

Roots and ratios, no pen

Mental arithmetic only.

1. $\sqrt{1,440,000}$ (5s)
Answer: 1,200
2. $\sqrt{(2 \times 12,000 \times 15 \div 4)}$ (10s)
Answer: $\sqrt{90,000} = 300$
3. $\sqrt{(2 \times 25,000 \times 80 \div 4)}$ (10s)
Answer: $\sqrt{1,000,000} = 1,000$
4. D up 69%: Q^* factor? (6s)
Answer: $\sqrt{1.69} = 1.3$
5. H up 25%: Q^* factor? (8s)
Answer: $1 \div \sqrt{1.25} \approx 0.89$
6. S down 51%: Q^* factor? (6s)
Answer: $\sqrt{0.49} = 0.7$
7. D doubles and H doubles: Q^* factor? (5s)
Answer: 1 — unchanged
8. $Q = 1,250$ when $Q^* = 1,000$: cost penalty? (10s)
Answer: $0.5 \times (1.25 + 0.8) = 1.025$, so 2.5%

Spot the conversion

Each prompt hides one conversion — state it.

1. Demand 2,000 units per month (4s)
Answer: $D = 24,000$ per year
2. Holding cost 10% of a 30 unit price (5s)
Answer: $H = 3$ per unit-year
3. Carrying cost 0.50 per unit per month (5s)
Answer: $H = 6$ per unit-year
4. 900 units per lot; one lot lasts 3 months (6s)

Answer: $D = 3,600$ per year

5. $D = 10,000$, 250 working days, lead time 5 days (8s)

Answer: $d = 40$; lead-time demand 200

6. 15 orders a year of 2,400 units each (5s)

Answer: $D = 36,000$ per year

7. Reorder level 600 including 100 safety stock (5s)

Answer: Lead-time demand = 500

Guided walk-through: one passage, four questions

A components stockist sells 15,000 units a year over 250 working days. An order costs 48; holding a unit for a year costs 4. Delivery takes 5 working days, and the stockist holds 120 units of safety stock. Use $Q^* = \sqrt{(2DS \div H)}$, $ROP = d \times L + SS$, and relevant cost = $(D \div Q) \times S + (Q \div 2) \times H$.

Four questions: EOQ, orders per year, reorder point, cost of lots of 1,000.

1. **0:00–0:20 — Label.** $D = 15,000$, $S = 48$, $H = 4$, days = 250, $L = 5$, $SS = 120$. $Q = 1,000$ appears only in Q4.
2. **0:20–0:50 — Q1, the EOQ.** $2 \times 48 \div 4 = 24$; $15,000 \times 24 = 360,000$; $\sqrt{360,000} = 600$.
3. **0:50–1:05 — Q2, orders a year.** $N = 15,000 \div 600 = 25$; bonus, cycle = $250 \div 25 = 10$ days.
4. **1:05–1:35 — Q3, reorder point.** $d = 15,000 \div 250 = 60$; lead-time demand $60 \times 5 = 300$; $ROP = 420$. A 300 option forgets the reserve; 540 counts it twice.
5. **1:35–2:20 — Q4, cost at $Q = 1,000$.** Not optimal, so both: ordering $15 \times 48 = 720$, holding $500 \times 4 = 2,000$, total 2,720. At Q^* it would be $600 \times 4 = 2,400$, so a higher figure is right.
6. **2:20 — Done.** Four questions in 140 seconds against a budget of 360.

Notice the order of work Q first, then N and d , and every later question is one line. If a set opens with a reorder-point question, label everything first anyway — d never needed Q .

Progressive practice

Three untimed sets. Accuracy first — make each variant automatic before you race it.

Live drill online: Easy — compute Q , N , average stock, one cost at Q —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=easy&n;=6&timed;=0>

Easy: D , S and H given, one line of the kit. Move on at 6 of 6.

Live drill online: Medium — given Q , conversions, percentage changes, two-policy comparisons —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=medium&n;=6&timed;=0>

Medium: a hidden conversion, or a Q that isn't optimal. Move on at 5 of 6.

Live drill online: Hard — reverse-engineering, ROP with safety stock, cost penalties, discounts —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=hard&n;=6&timed;=0>

Hard: two ideas chained — the hidden S , then a rescale. Move on at 4 of 6.

Speed training

Now the clock, with targets from the budget table. Log where the seconds go: reading, labelling or the root.

Live drill online: Easy under 45 s each —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=easy&n;=6&timed;=1>

Live drill online: Medium under 75 s each —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=medium&n;=6&timed;=1>

Live drill online: Hard under 90 s each —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=hard&n;=6&timed;=1>

- **Missed on easy?** You're re-reading. Label once, then go back only for a number.
- **Slow on medium?** It's the root. Cancel first; strip zeros in pairs.
- **Slow on hard?** You're recomputing Q^* where a ratio would do, or doing both costs at the optimum.

Exam application

This family arrives as one passage with four or five linked questions. Treat the set as a unit: budget six to seven minutes, the first on labels and Q^* .

- **Answer everything** — nothing is deducted for a wrong one. If a root won't resolve, bracket it and take the nearest option.
- **Work the set in order** unless the first question is the heavy one; then bank the one-liners first.
- **Match units before numbers.** Units, orders, days or currency: one glance kills two options.
- **Two options a factor of 2 apart?** That is Q versus $Q \div 2$, or one cost versus the total.
- **Skip forward** if a passage adds something outside the kit — uncertain demand, backorders.

Live drill online: Exam simulation — 90 s per question, options only —

<https://dmatprepguide.com/?try=drill&cat;=gam&tier;=hard&n;=6&timed;=1>

The last ten seconds of every set Costs at Q equal? ROP below Q ? $N \times Q \approx D$? D in units per year?
Four checks, one glance, several marks.

Cheat sheet

$$Q^* = \sqrt{(2DS \div H)}$$

$$N = D \div Q \cdot \text{Cycle} = \text{working days} \div N = Q \div d$$

$$\text{Ordering} = (D \div Q) \times S \cdot \text{Holding} = (Q \div 2) \times H$$

$$\text{At } Q^*: \text{ordering} = \text{holding} \cdot \text{TC}^* = \sqrt{(2DSH)} = Q^* \times H$$

$$\text{Average stock} = Q \div 2 \text{ (+ SS if a reserve is held)}$$

$$d = D \div \text{working days (as stated)} \cdot \text{ROP} = d \times L + \text{SS}$$

$$\text{Reverse: } S = HQ^2 \div 2D \cdot H = 2DS \div Q^2 \cdot D = HQ^2 \div 2S$$

$$\text{Scaling: } Q^* \propto \sqrt{D}, \sqrt{S}, 1 \div \sqrt{H} \cdot D \times 4 \rightarrow Q^* \times 2$$

$$\text{Penalty: } 0.5 \times (Q \div Q^* + Q^* \div Q) \cdot \text{half or double} \rightarrow +25\%$$

Write these from memory in 60 seconds.

- Labelled D, S, H, Q, L, SS before any arithmetic
- D per year, H per unit-year, S per order
- Given $Q \rightarrow$ both costs; 'optimal' $\rightarrow$ one cost
- Cancelled before multiplying; zeros stripped in pairs
- Safety stock added once; working days as stated
- Answer's units match the question's; nothing left blank

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