LF LearnFrenzy

QUANTITATIVE APTITUDE · FREE STUDY MATERIAL

Pipes and Cisterns

Formulas & Shortcut Tricks

Every important formula, shortcut and exam trick for Pipes and Cisterns in one place – with solved examples, common mistakes and a one-page revision sheet.

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USEFUL FOR

- Bank PO & Clerk (IBPS, SBI, RBI)
- SSC CGL / CHSL / MTS
- Railways (RRB NTPC, Group D)
- Campus placements (TCS, Infosys, Wipro, Accenture)
- UPSC CSAT & state PSC exams

Practise **Pipes and Cisterns** free on LearnFrenzy – questions with instant explanations →

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1 Topic introduction

What it is, why it matters and how it is asked

Pipes and Cisterns is Time and Work with water. An inlet pipe fills a tank (positive work); an outlet pipe or a leak empties it (negative work). If a pipe fills a tank in t hours, it fills 1/t of the tank every hour.

Exams combine pipes working together, leaks, partly filled tanks, pipes closed or opened part-way, pipes working in alternate hours and tank capacities in litres. The LCM (capacity-units) method makes nearly all of them quick.

Why it matters in exams

- Bank prelims and SSC papers ask one or two questions.
- It reuses the Time and Work method directly.
- The LCM method turns fractions into whole numbers.

Where it is used

- Water tanks, reservoirs and pumps.
- Leak detection and drainage.
- Any process with an input and an output rate.

Common question patterns

Two or more inlets
Time to fill together.

Inlet and outlet
Net filling rate.

Leaks
Time for the leak to empty a full tank.

Three pipes
Pairwise times or mixed inlets and outlets.

Closed part-way
Pipes opened or closed after some time.

Alternate hours
Pipes taking turns.

Capacity in litres
Rates given in litres per minute.

Efficiency
One pipe x times as fast; flow $\propto d^2$.

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2 Important formulas

Cards marked MOST USED are the ones to revise first

Rates of pipes

Work per hour

MOST USED

Fills in t hours → +1/t of the tank per hour. Empties in t hours → −1/t per hour

Add rates, never times.

EXAMPLE A pipe filling in 6 h fills **1/6** of the tank each hour.

Two inlets together

MOST USED

Time = ab/(a + b)

Product over sum.

EXAMPLE 12 h and 15 h → 180/27 = 20/3 h = **6 h 40 min**.

Inlet and outlet together

MOST USED

Fills in a, empties in b (b > a) → time to fill = ab/(b − a)

The outlet's rate is subtracted.

EXAMPLE Fills in 8 h, empties in 12 h → 96/4 = **24 h**.

Leak

MOST USED

Fills in a h, but in b h with a leak → leak empties a full tank in ab/(b − a)

The leak's rate = 1/a − 1/b.

EXAMPLE 6 h, and 8 h with the leak → 48/2 = **24 h**.

Three pipes and part-filled tanks

Three pipes

1/T = 1/a + 1/b − 1/c (c an outlet)

Signs show which pipes fill and which empty.

EXAMPLE 10 h and 12 h fill, 20 h empties → 8/60 per hour → **7.5 h**.

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Pairwise times

MOST USED

> **A + B in x, B + C in y, C + A in z → all three: 2xyz/(xy + yz + zx)**

Adding the three pairs counts each pipe twice.

EXAMPLE x = 6, y = 8, z = 12 → 1,152/216 = **16/3 h** (5 h 20 min).

Partly filled tank

> **Time = (part still to fill) × (time for a full tank)**

Trap: treating a partly filled tank as empty.

EXAMPLE Tank ¼ full, pipe fills in 12 h → ¾ × 12 = **9 h**.

Capacity and efficiency

Capacity in litres

> **Capacity = rate × time; a leak of r L/min emptying the tank in t min → capacity = r × t**

Work in one unit – litres per minute or per hour.

EXAMPLE Leak of 3 L/min empties the full tank in 24 h → 3 × 1,440 = **4,320 L**.

Efficiency and diameter

> **Rate ∝ 1/time; at the same flow speed, rate ∝ (diameter)²**

Twice as fast → half the time.

EXAMPLE Diameters 2 cm and 3 cm → rates **4 : 9**.

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3 Shortcut tricks & smart techniques

Each trick says when to use it – that matters as much as the trick

LCM (capacity-units) method

MOST USED

USE WHEN Several pipes with different times.

1. Take the tank as the LCM of the times, in units.
2. Each pipe's units per hour = LCM ÷ its time; outlets negative.

EXAMPLE A 20 h, B 30 h fill, C 60 h empties → 60 units, 3 + 2 – 1 = 4 per hour → **15 h**.

Alternate hours

MOST USED

USE WHEN Pipes open one after the other, an hour each.

1. Find the units done in one full cycle.
2. Run whole cycles, then finish the last part – watch for overshoot.

EXAMPLE A 4 h, B 6 h alternately (A first) → 12 units, 5 per 2 h → 10 after 4 h → 2 more at 3/h → **4 h 40 min**.

One pipe closed part-way

USE WHEN Pipes start together and one is closed later.

1. Work done together for the first t hours.
2. The rest is done by the pipe still open.

EXAMPLE A 10 h, B 15 h together for 3 h, then B closed → ½ done, A needs 5 h → **8 h** in all.

x times as fast

USE WHEN One pipe is a multiple faster than another.

1. Give the slower pipe 1 part, the faster x parts.
2. Together (x + 1) parts.

EXAMPLE Together 6 h, A twice as fast as B → A alone 6 × 3/2 = **9 h**.

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4 Solved examples

The full method on the left, the exam shortcut on the right

1 TWO INLETS

Two pipes can fill a tank in 20 minutes and 30 minutes. How long will they take together?

STEP BY STEP

1. Rates: 1/20 + 1/30 = 5/60 = 1/12.
2. Time = 12 minutes.

SHORTCUT

600/50 = 12.

Why it works: Trap: 25 min – averaging the times.

Answer: 12 minutes

2 INLET AND OUTLET

A pipe fills a tank in 5 hours and another empties it in 7 hours. If both are opened together on an empty tank, when is it full?

STEP BY STEP

1. Net rate = 1/5 – 1/7 = 2/35.
2. Time = 35/2 = 17.5 h.

SHORTCUT

ab/(b – a) = 35/2.

Why it works: Trap: 35/12 h – adding the outlet's rate.

Answer: 17 h 30 min

3 LEAK

A cistern normally fills in 9 hours, but because of a leak it takes 10 hours. How long would the leak take to empty the full cistern?

STEP BY STEP

1. Leak rate = 1/9 – 1/10 = 1/90.
2. Time = 90 hours.

SHORTCUT

9 × 10/(10 – 9) = 90.

Why it works: The leak removes the difference of the two rates.

Answer: 90 hours

4 THREE PIPES

Pipes A and B fill a tank in 6 h and 8 h; pipe C empties it in 12 h. If all three are opened together, when is the tank full?

STEP BY STEP

1. Rate = 1/6 + 1/8 – 1/12 = (4 + 3 – 2)/24 = 5/24.
2. Time = 24/5 h = 4.8 h.
3. = 4 h 48 min.

SHORTCUT

LCM 24: 4 + 3 – 2 = 5 units/h → 24/5.

Why it works: Capacity units avoid fractions.

Answer: 4 h 48 min

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5 PAIRWISE

Pipes A and B fill a tank in 10 h, B and C in 12 h, C and A in 15 h. How long will all three take together, and A alone?

STEP BY STEP

1. 2(A + B + C) = 1/10 + 1/12 + 1/15 = 15/60 → A + B + C = 1/8.
2. All three: 8 h.
3. A = 1/8 − 1/12 = 1/24 → A alone 24 h.

SHORTCUT

2xyz/(xy + yz + zx) = 3,600/450 = 8.

Why it works: A alone = all three minus (B + C).

Answer: 8 h; A alone 24 h

6 CLOSED PART-WAY

Pipes A and B fill a tank in 12 min and 16 min. Both are opened together. After how many minutes should B be closed so that the tank is full in 9 minutes?

STEP BY STEP

1. A works all 9 min: 9/12 = ¾.
2. B must fill ¼ → ¼ × 16 = 4 min.
3. Close B after 4 minutes.

SHORTCUT

Remaining part × B's time.

Why it works: Work from the pipe that runs the whole time.

Answer: After 4 minutes

7 ALTERNATE HOURS

Pipes A and B fill a tank in 6 h and 9 h. They are opened in alternate hours, starting with A. When is the tank full?

STEP BY STEP

1. Tank = 18 units; A 3, B 2 per hour.
2. 2-hour cycle = 5 units; 3 cycles = 15 units in 6 h.
3. 7th hour (A) adds 3 → 18. Full in 7 h.

SHORTCUT

Cycles first, then the last part.

Why it works: Trap: 7.2 h – dividing 18 by 2.5 per hour.

Answer: 7 hours

8 CAPACITY

A leak can empty a full tank in 8 h. An inlet filling 6 litres a minute is opened, and the tank now empties in 12 h. Find the capacity.

STEP BY STEP

1. Inlet = 360 L/h.
2. C/8 − 360 = C/12.
3. C(1/8 − 1/12) = 360 → C/24 = 360 → C = 8,640 L.

SHORTCUT

Inlet fills in 8 × 12/(12 − 8) = 24 h → 24 × 360.

Why it works: Equate the net emptying rate.

Answer: 8,640 litres

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9 EFFICIENCY

Pipe A is three times as fast as pipe B. Together they fill a tank in 36 minutes. How long would B take alone?

STEP BY STEP

1. Rates A : B = 3 : 1 → together 4 parts.
2. B does 1 part in the time all 4 parts take 36 min.
3. B alone = 4 × 36 = 144 min.

SHORTCUT

(x + 1) × together time.

Why it works: B's share of the work is only ¼.

Answer: 144 minutes

10 PART FILLED

A tank is 2/5 full. An inlet fills it in 10 h and an outlet empties it in 15 h. Both are opened. How long until it is full?

STEP BY STEP

1. Net rate = 1/10 − 1/15 = 1/30.
2. Left to fill = 3/5.
3. Time = 3/5 × 30 = 18 h.

SHORTCUT

Full tank 30 h → 3/5 of it.

Why it works: Trap: 30 h – ignoring the water already in the tank.

Answer: 18 hours

11 DIAMETER

Two pipes of diameters 4 cm and 6 cm carry water at the same speed. The wider one fills a tank in 40 minutes. How long would the narrower one take?

STEP BY STEP

1. Rate $\propto d^2$ → 16 : 36 = 4 : 9.
2. Time $\propto$ 1/rate → narrower takes 40 × 9/4.
3. = 90 minutes.

SHORTCUT

$40 \times (6/4)^2$.

Why it works: Trap: 60 min – using the diameter ratio, not its square.

Answer: 90 minutes

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5 Important exam tips

Patterns, traps and habits that save marks

Frequently asked question patterns

- Two pipes, or an inlet and an outlet.
- Leak found from a delay.
- Three pipes with signs.
- Pairwise times.
- Pipe closed part-way.
- Alternate hours.
- Capacity in litres.

Common mistakes to avoid

- Adding times instead of rates.
- Forgetting to subtract the outlet.
- Treating a partly filled tank as empty.
- Overshooting in alternate-hour questions.
- Using the diameter instead of its square.
- Mixing litres per minute with per hour.

Points to remember

- Rate = 1/time.
- Two inlets: ab/(a + b).
- Inlet – outlet: ab/(b – a).
- Leak: ab/(b – a).
- Pairs: 2xyz/(xy + yz + zx).

Speed and accuracy

- Use the LCM as the tank capacity.
- Give outlets negative units.
- Check the last cycle in alternate hours.
- Convert minutes to hours only at the end.

Preparation strategy

- Revise Time and Work alongside this topic.
- Practise on LearnFrenzy in order: Easy → Medium → Hard → Exam Pattern Mix → Data Sufficiency.
- Aim for 40–60 seconds per question.
- Keep an error log of sign and overshoot slips.
- Read the Quick Revision Sheet (next page) the night before the exam.

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6 Quick revision sheet

Everything on one page for the night before the exam

Formulas

Rate	**±1/t per hour**	Two inlets	**ab/(a + b)**
Inlet and outlet	**ab/(b − a)**	Leak empties	**ab/(b − a)**
Three pipes	**1/a + 1/b − 1/c**	Pairwise times	**2xyz/(xy + yz + zx)**
Partly full	**part left × full time**	Capacity	**rate × time**
x times faster	**slower = (x + 1) × together**	Diameter	**rate ∝ d²**

Shortcut tricks

- Capacity = LCM of times.
- Outlets → negative units.
- Alternate: cycles, then the rest.
- Closed later: together part + rest.
- Average of times is never the answer.
- 1 h = 60 min; 0.8 h = 48 min.

Must-know numbers

Hours to minutes	0.2 h = 12 min · 0.25 h = 15 min · ⅓ h = 20 min · 0.5 h = 30 min · ⅔ h = 40 min · 0.8 h = 48 min
Units	1 m³ = 1,000 L · 1 L/min = 60 L/h · 1 day = 1,440 min

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7 A message from LearnFrenzy

For everyone preparing for placements, competitive and government exams

Keep going – you are closer than you think

Success in examinations is not just about how many hours you study. It is about how effectively you understand concepts, practise questions, and improve yourself every day.

Every formula you learn, every problem you solve, and every mistake you correct brings you one step closer to your goal.

Whether you are preparing for campus placements, competitive examinations, or government jobs, remember that consistency, confidence, and smart preparation make a real difference.

Don’t just memorize formulas. Understand the concepts, practise smart techniques, and develop the confidence to solve problems independently.

Your hard work today can create the opportunities you dream of tomorrow.

— Team LearnFrenzy

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