Clocks

~ Reasoning · SSC Exams ~

← circled = key tricks!

A clock has two hands — the short **Hour hand** and the long **Minute hand** — moving at different constant speeds. Every SSC clock question is really an angle puzzle: use the speed difference between the hands to find angles, meeting points, or errors in time.

① Meet the Hands – Key Speeds

Minute hand: covers 360° in 60 min ∴ speed = **6°/min**.

Hour hand: covers 360° in 12 h (720 min) ∴ speed = **½°/min**.

Relative speed: every minute, the minute hand gains (6−½) = **5½° on the hour hand** — the single most useful number in this whole chapter!

Also: 1 hour-gap (e.g. 12 to 1) = **30°**, and each minute-tick = **6°**.

Worked example – angle at 10:10

Step 1 — hour hand = 30×10 + ½×10 = 300+5 = **305°**. minute hand = 6×10 = **60°**.

Step 2 — difference = |305−60| = 245°; since >180°, use 360−245.

Answer → **115°**. ✅

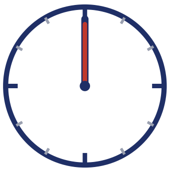
5½° per minute is the golden number — almost every clocks formula (angle, coincide, opposite, right angle) is built directly from it.

Always convert to (Hours, Minutes) first, then plug into 30H and 5.5M **separately** — mixing them up is the #1 mistake.

② Clock Basics – Degrees on the Dial

Rule

The dial is a full **360°** circle split into 12 hour-marks (**30°** apart) and 60 minute-ticks (**6°** apart). Distance between two consecutive numbers = 30°; between two consecutive minute-ticks = 6°.



12→**0°**/360°	1→**30°**	2→**60°**	3→**90°**
4→**120°**	5→**150°**	6→**180°**	7→**210°**
8→**240°**	9→**270°**	10→**300°**	11→**330°**

Worked example – angle at 3:00 (o'clock case)

At an exact o'clock time (M=0), the angle is simply the hour number's distance from 12, the **shorter** way round.

3 o'clock → **90°**. ✅

Try these – quick o'clock angles

5:00 → **150°**

8:00 → **120°** (360−240)

11:00 → **30°** (360−330)

6:00 → **180°**

Memorise the 12-entry degree table above cold – it turns every o'clock question into a 2-second lookup.

③ The Angle Formula ∠

Rule

Position of hour hand from 12 = **30H + ½M** (it creeps forward with the minutes too!).

Position of minute hand = **6M**. So:

$$\theta = |30H - 5.5M|$$

If θ > 180°, report **360° − θ** instead — a clock always shows the smaller of the two arcs.

Worked example — angle at 3:40

Step 1 — hour = 30×3+½×40 = 90+20 = **110°**. minute = 6×40 = **240°**.

Step 2 — |110−240| = 130°, and 130° ≤ 180° so keep it.

Answer → **130°**. ✅

Try these — quick angle drills

5:50 → **125°**

2:20 → **50°**

9:15 → **172.5°**

6:15 → **97.5°**

If |30H−5.5M| comes out above 180°, don't panic — just subtract it from 360°. The clock always reports the smaller angle unless the question says otherwise.

④ Hands Coincide (Overlap)

Rule

Hands coincide when $\theta=0$, i.e. $\mathbf{30H = 5.5M}$ ∴ $M = 60H/11$ minutes past H o'clock.
Consecutive coincidences are **720/11 = 65 5/11 min** apart → they happen **11 times every 12 h** → **22 times a day** (not 24 — the 11 o'clock and 12 o'clock overlaps merge into one moment).

Worked example — coincide between 4 and 5

$H=4 \rightarrow M = 60\times4/11 = 240/11 =$ **21 9/11** min.
Answer → hands coincide at **4:21 9/11** (≈4:21:49). ✅

Quick facts — coincide times per hour

$H=1$ → **5 5/11** min	$H=2$ → **10 10/11** min	$H=6$ → **32 8/11** min

Trap → at $H=11$: $M = 60\times11/11 = 60$, which is not "11:60" — it is exactly **12:00:00**! That's why there are only 22, not 24, coincidences per day.

⑤ Hands Opposite (180°) —

Rule

Hands are opposite when $\theta = 180°$ ∴ **$M = (30H \pm 180) \times 2/11$** — keep only the root with $0 \le M < 60$.

Like coincidence, this happens **11 times every 12 h** → **22 times a day**.

Trivial case — 6 o'clock

At exactly **6:00** the hands are already opposite — angle = **180°**, zero calculation needed. A great sanity check for the formula.

Worked example — opposite between 7 and 8

Step 1 — $H=7$: try $M=(210-180)\times 2/11 = 30\times 2/11 = 60/11 =$ **5 5/11** min. (valid, $0 \le M < 60$)

Step 2 — other root $(210+180)\times 2/11 = 70.9\ldots > 60$, so rejected.

Answer → hands are opposite at **7:05 5/11** (≈7:05:27). ✅

Quick facts — opposite times

H=2 → **43 7/11** min past 2

H=9 → **16 4/11** min past 9

💡 Compute BOTH ± roots every time — only one usually survives the $0 \le M < 60$ test, but never assume which one without checking.

⑥ Right Angle (90°) ∟

Rule

Hands are perpendicular when θ=90° ∴ **M = (30H ± 90) × 2/11** — usually gives **TWO** valid times per hour.

24 possible slots in 12 h, minus 2 boundary merges (near 3 & 9) = **22 times/12h** → **44 times a day**.

Trivial case — 9 o'clock

At **9:00** the hands are already perpendicular — angle = **90°**, an instant sanity check.

Worked example — right angle between 7 and 8 (TWO answers!)

Step 1 — H=7: M_1 = (210−90)×2/11 = 120×2/11 = **21 9/11** min.

Step 2 — M_2 = (210+90)×2/11 = 300×2/11 = **54 6/11** min. Both lie in 0–59, so both are valid!

Answer → right angles occur at **7:21 9/11** AND **7:54 6/11**. ✅

Trap ⟶ questions phrased "between 7 and 8" often have TWO correct right-angle moments.
Read carefully – "first time"/"second time"/"how many times" all need different answers!

⑦ Minutes to Make a Given Angle ∠

The one master formula

For ANY target angle θ between H and H+1 o'clock: **$M = (30H \pm \theta) \times 2/11$**. Keep only roots with $0 \le M < 60$ — this single formula covers coincide (θ=0), opposite (θ=180), right angle (θ=90) and everything in between.

Worked example — 50° apart, between 3 and 4

Step 1 — $H=3$, $\theta=50°$: $M_1 = (90-50)\times 2/11 = 80/11 =$ **7 3/11** min.

Step 2 — $M_2 = (90+50)\times 2/11 = 280/11 =$ **25 5/11** min. Both valid.

Answer → **3:07 3/11** AND **3:25 5/11**. ✅

Formula recap by angle type

θ=0° (coincide): $M=60H/11$	**θ=180°** (opposite): $M=(30H\pm180)2/11$
θ=90° (right angle): $M=(30H\pm90)2/11$	**general θ**: $M=(30H\pm\theta)2/11$

💡 Always compute BOTH roots (±) and discard any M outside 0–59.99 — that's how you dodge the classic "missed the second answer" trap.

⑧ Fast / Slow Clocks (Gaining / Losing)

Rule — the ratio method

If a clock **gains g** min every real hour, then while 60 real minutes pass, its dial advances (60+g) minutes. If it **loses ℓ** min every hour, the dial advances only (60−ℓ) minutes.

Faulty-minutes ∴ Real-minutes = (60±error) ∴ 60

Worked example — a GAINING clock

A clock gains **5 min every hour**. Set correct at 12 noon, it now shows **6:30 pm**. Find the true time.

Step 1 — faulty elapsed = 6h30m = 390 min. Ratio faulty:real = 65:60.

Step 2 — real elapsed = 390 × 60 / 65 = **360 min = 6h00m**.

Answer → true time = 12:00 + 6h00m = **6:00 pm**. ✅

Worked example — a LOSING clock

A watch loses **3 min every hour**. Set right at 6:00 am. What will it SHOW at true 6:00 pm (12 h later)?

Step 1 — real elapsed = 12h = 720 min. Ratio faulty:real = 57:60.

Step 2 — faulty shown = 720 × 57 / 60 = **684 min = 11h24m**.

Answer → shown time = 6:00am + 11h24m = **5:24 pm**. ✅

Quick facts — error per day

gains 2 min / hr → **48 min / day** fast

loses 1.5 min / hr → **36 min / day** slow

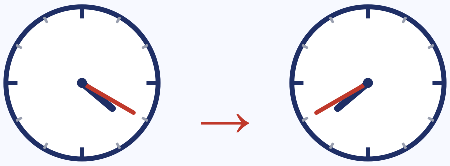
Set up the ratio (60±error):60 FIRST, then cross-multiply — never add/subtract minutes directly, that's where mistakes creep in.

⑨ Mirror Image of a Clock

Rule

A vertical mirror reflects a clock into its "12 o'clock complement": **Mirror time = 11:60 – actual time** (subtract minutes from 60, hours from 11).

Worked example — mirror of 4:20



Actual: 4:20 Mirror: 7:40

Step 1 — minutes: 60–20 = **40**.

Step 2 — hours: 11–4 = **7**.

Answer → mirror shows **7:40**. ✅

Quick facts — more mirrors

2:50 → **9:10**	9:00 → **3:00**

Trap → if minutes = 00 exactly, use **12–H** (not 11–H) for the mirror hour — e.g. 9:00 mirrors to 3:00, not 2:00!

How to Attack ANY Clocks Question

1→ Convert the time to (H, M). Compute hour-hand position = **30H+½M** and minute-hand position = **6M** — never mix them.

2→ Angle = |difference|; if it's >180°, use **360° minus it**.

3→ For "when do hands..." questions use **M=(30H±θ)x2/11** and test BOTH roots for 0≤M<60.

4→ For fast/slow clock Qs, set up the ratio **(60±error):60** and cross-multiply — never add minutes directly.

5→ For mirror-image Qs, use **11:60–time** (or 12–H when minutes=0).

Common traps → forgetting the hour hand moves during the minutes (using just 30H); picking only one root of a ± equation; confusing 22x/day (coincide/opposite) with 44x/day (right angle); mixing up 11–H vs 12–H in mirror problems.

Quick Pattern Gallery — one-glance revision

Minute hand: 6°/min	**Hour hand:** ½°/min
Relative speed: 5½°/min	**Angle formula:** |30H–5.5M|
Coincide: M=60H/11, 22x/day	**Opposite (180°):** 22x/day
Right angle (90°): 44x/day	**General θ:** M=(30H±θ)2/11
Fast/slow ratio: (60±e):60	**Mirror image:** 11:60–time
Coincide gap: 65 5/11 min	**Full dial:** 360° = 12×30°

Exercise — Solve the Clock

Real SSC-style clock questions — solve, then check the Answer Key on the next page.

Q1. Angle between hands at 4:20?
(1) 5° (2) 10° (3) 15° (4) 20°

Q2. Angle between hands at 7:30?
(1) 35° (2) 40° (3) 45° (4) 50°

Q3. Between 3 & 4, hands coincide at 3:?
(1) 16 4/11 (2) 15 5/11 (3) 16 5/11 (4) 17 4/11

Q4. Between 8 & 9, hands opposite at 8:?
(1) 10 10/11 (2) 11 1/11 (3) 9 10/11 (4) 10 1/11

Q5. How many times/day do hands coincide?
(1) 11 (2) 22 (3) 24 (4) 44

Q6. How many times/day are hands at right angles?
(1) 22 (2) 24 (3) 44 (4) 48

Q7. Clock gains 5 min/hr, set right at 8am, shows 2:30pm. True time?
(1) 2:00pm (2) 1:30pm (3) 2:30pm (4) 1:45pm

Q8. Watch loses 3 min/hr, set right 6am. Shows at true 6pm?
(1) 5:24pm (2) 5:36pm (3) 5:48pm (4) 5:12pm

Q9. Mirror image of 4:20?
(1) 7:40 (2) 7:20 (3) 8:40 (4) 7:50

Q10. Mirror image of 9:00?
(1) 2:00 (2) 3:00 (3) 9:00 (4) 11:00

Q11. Between 7&8, SECOND right-angle time?
(1) 7:21 9/11 (2) 7:54 6/11 (3) 7:45 (4) 7:38 2/11

Q12. Angle between hands at 12:30?
(1) 165° (2) 175° (3) 150° (4) 155°

✓ Solve every question on paper first — write the H, M and both ± roots where needed — then flip the page to check.

Answer Key

Q1→10° — hour=130°,min=120°,diff=10°. **Q2→45°** — hour=225°,min=180°,diff=45°.
Q3→16 4/11 — M=60×3/11=180/11. **Q4→10 10/11** — M=(240−180)2/11=120/11.
Q5→22 — 11 coincidences×2 (am+pm), 12&11 o'clock overlaps merge into one.
Q6→44 — 22 right-angle moments every 12 h × 2.
Q7→2:00pm — faulty:real=65:60; 390×60/65=360min=6h → 8am+6h=2pm.
Q8→5:24pm — faulty:real=57:60; 720×57/60=684min=11h24m → 6am+11h24m.
Q9→7:40 — 60−20=40; 11−4=7. **Q10→3:00** — M=0 special case, use 12−9=3.
Q11→7:54 6/11 — M_2=(210+90)2/11=600/11, the later of the two roots.
Q12→165° — hour=15° (12×30+½×30),min=180°,diff=165°.

Score yourself

10–12 correct → **excellent**, clocks is your strength! 6–9 → **good**, revisit pages 3–7. Below 6 → **redo** the "How to Attack" steps on page 10 slowly.

60-Second Recap

Minute hand: **6°/min**	Hour hand: **½°/min**
Relative speed: **5½°/min**	Angle: **|30H−5.5M|** (≤180°)
Coincide: M=60H/11, **22×/day**	Opposite: M=(30H±180)2/11, **22×/day**
Right angle: M=(30H±90)2/11, **44×/day**	General: M=(30H±θ)2/11
Fast/slow ratio: **(60±e):60**	Mirror: **11:60−time** (or 12−H if M=0)
Coincide gap: **65 5/11 min**	Full dial: 360° = 12×30° = 60×6°

☆ Watch the hands, master the angles! ☆

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