

TIME

A 24-HOUR TIME FORMAT

A.1 CONVERTING TO 24-HOUR TIME

Ex 1: Convert 11 : 30 AM to 24-hour time:

:

Answer:

- Check the period: It's AM, so keep the hours as they are.
- Write the time: 11 h + 30 min = 11 : 30.
- Final answer: **11:30**.

Ex 2: Convert 6 : 15 PM to 24-hour time:

:

Answer:

- Check the period: It's PM, so add 12 hours to the time.
- Add the hours: 6 h + 12 h = 18 h.
- Include the minutes: 18 h + 15 min = 18 : 15.
- Final answer: **18:15**.

Ex 3: Convert 10 : 40 PM to 24-hour time:

:

Answer:

- Check the period: It's PM, so add 12 hours to the time.
- Add the hours: 10 h + 12 h = 22 h.
- Include the minutes: 22 h + 40 min = 22 : 40.
- Final answer: **22:40**.

Ex 4: Convert 8 : 30 AM to 24-hour time:

:

Answer:

- Check the period: It's AM, so keep the hours as they are (add a zero before single digits).
- Write the time: 8 h + 30 min = 08 : 30.
- Final answer: **08:30**.

Ex 5: Convert 1 : 20 PM to 24-hour time:

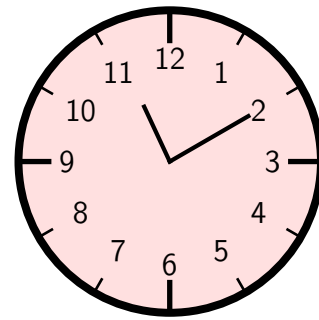
:

Answer:

- Check the period: It's PM, so add 12 hours to the time.
- Add the hours: 1 h + 12 h = 13 h.
- Include the minutes: 13 h + 20 min = 13 : 20.
- Final answer: **13:20**.

A.2 READING CLOCK TIME IN 24-HOUR FORMAT

Ex 6: What is this clock time in 24-hour format?



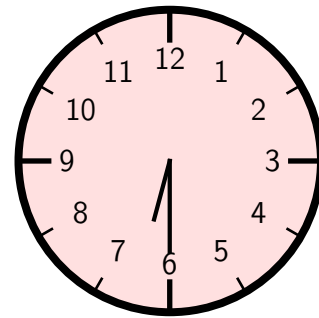
Morning

:

Answer:

- Check the time of day: It's morning (AM), so keep the hours as shown.
- Read the clock: 11 h + 10 min.
- Write in 24-hour format: **11:10**.

Ex 7: What is this clock time in 24-hour format?



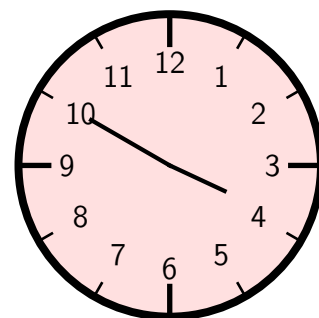
Morning

:

Answer:

- Check the time of day: It's morning (AM), so keep the hours (add a zero since it's before 10).
- Read the clock: 6 h + 30 min.
- Write in 24-hour format: **06:30**.

Ex 8: What is this clock time in 24-hour format?



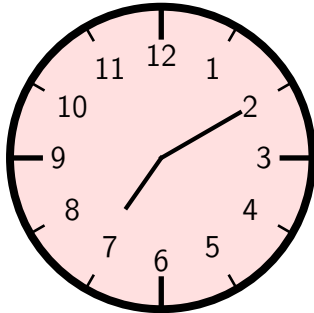
Afternoon

15:50

Answer:

- Check the time of day: It's afternoon (PM), so add 12 hours.
- Read the clock and adjust: $3 \text{ h} + 12 \text{ h} = 15 \text{ h}$, plus 50 min.
- Write in 24-hour format: **15:50**.

Ex 9: What is this clock time in 24-hour format?



Evening

19:10

Answer:

- Check the time of day: It's evening (PM), so add 12 hours.
- Read the clock and adjust: $7 \text{ h} + 12 \text{ h} = 19 \text{ h}$, plus 10 min.
- Write in 24-hour format: **19:10**.

B UNITS OF TIME

B.1 CHOOSING THE RIGHT UNITS OF TIME

MCQ 10: Which unit would you use to measure the time it takes to clean up the classroom after a project?

Check one answer:

- ☐ seconds
- ☒ minutes
- ☐ hours
- ☐ weeks

Answer: The best unit is **minutes**, because cleaning a classroom usually takes a short amount of time, more than seconds but less than hours.

MCQ 11: Which unit would you use to measure the time it takes to run 100 meters?

Check one answer:

- ☒ seconds
- ☐ minutes
- ☐ hours
- ☐ years

Answer: The best unit is **seconds**, because running 100 meters is a very quick event.

MCQ 12: Which unit would you use to measure the travel time from Earth to Mars?

Check one answer:

- ☐ seconds
- ☐ minutes
- ☐ hours
- ☒ years

Answer: The best unit is **years**, because traveling to Mars takes a very long time, much more than days or weeks.

MCQ 13: Which unit would you use to measure the time it takes to boil an egg?

Check one answer:

- ☐ seconds
- ☒ minutes
- ☐ hours
- ☐ days

Answer: The best unit is **minutes**, because boiling an egg takes a few minutes, not just seconds or as long as hours.

C CONVERTING UNITS OF TIME

C.1 CONVERTING UNITS OF TIME

Ex 14: Convert 1 hour 45 minutes to minutes:

$$1 \text{ h } 45 \text{ min} = \boxed{105} \text{ min}$$

Answer:

$$\begin{aligned} 1 \text{ h } 45 \text{ min} &= 1 \times 60 \text{ min} + 45 \text{ min} \\ &= 60 \text{ min} + 45 \text{ min} \\ &= 105 \text{ min} \end{aligned}$$

Ex 15: Convert 2 hours 30 minutes to minutes:

$$2 \text{ h } 30 \text{ min} = \boxed{150} \text{ min}$$

Answer:

$$\begin{aligned} 2 \text{ h } 30 \text{ min} &= 2 \times 60 \text{ min} + 30 \text{ min} \\ &= 120 \text{ min} + 30 \text{ min} \\ &= 150 \text{ min} \end{aligned}$$

Ex 16: Convert 3 hours 20 minutes to minutes:

$$3 \text{ h } 20 \text{ min} = \boxed{200} \text{ min}$$

Answer:

$$\begin{aligned} 3 \text{ h } 20 \text{ min} &= 3 \times 60 \text{ min} + 20 \text{ min} \\ &= 180 \text{ min} + 20 \text{ min} \\ &= 200 \text{ min} \end{aligned}$$

Ex 17: Convert 4 hours 15 minutes to minutes:

$$4 \text{ h } 15 \text{ min} = \boxed{255} \text{ min}$$

Answer:

$$\begin{aligned} 4 \text{ h } 15 \text{ min} &= 4 \times 60 \text{ min} + 15 \text{ min} \\ &= 240 \text{ min} + 15 \text{ min} \\ &= 255 \text{ min} \end{aligned}$$

Ex 18: Convert 2 minutes 15 seconds to seconds:

$$2 \text{ min } 15 \text{ s} = \boxed{135} \text{ s}$$

Answer:

$$\begin{aligned} 2 \text{ min } 15 \text{ s} &= 2 \times 60 \text{ s} + 15 \text{ s} \\ &= 120 \text{ s} + 15 \text{ s} \\ &= 135 \text{ s} \end{aligned}$$

Ex 19: Convert 3 minutes 40 seconds to seconds:

$$3 \text{ min } 40 \text{ s} = \boxed{220} \text{ s}$$

Answer:

$$\begin{aligned} 3 \text{ min } 40 \text{ s} &= 3 \times 60 \text{ s} + 40 \text{ s} \\ &= 180 \text{ s} + 40 \text{ s} \\ &= 220 \text{ s} \end{aligned}$$

Ex 20: Convert 5 minutes 25 seconds to seconds:

$$5 \text{ min } 25 \text{ s} = \boxed{325} \text{ s}$$

Answer:

$$\begin{aligned} 5 \text{ min } 25 \text{ s} &= 5 \times 60 \text{ s} + 25 \text{ s} \\ &= 300 \text{ s} + 25 \text{ s} \\ &= 325 \text{ s} \end{aligned}$$

Ex 21: Convert 1 day + 5 hours to hours:

$$1 \text{ d} + 5 \text{ h} = \boxed{29} \text{ h}$$

Answer:

$$\begin{aligned} 1 \text{ d} + 5 \text{ h} &= (1 \times 24 \text{ h}) + 5 \text{ h} \\ &= 24 \text{ h} + 5 \text{ h} \\ &= 29 \text{ h} \end{aligned}$$

Ex 22: Convert 2 days + 3 hours to hours:

$$2 \text{ d} + 3 \text{ h} = \boxed{51} \text{ h}$$

Answer:

$$\begin{aligned} 2 \text{ d} + 3 \text{ h} &= (2 \times 24 \text{ h}) + 3 \text{ h} \\ &= 48 \text{ h} + 3 \text{ h} \\ &= 51 \text{ h} \end{aligned}$$

Ex 23: Convert 1 hour to seconds:

$$1 \text{ h} = \boxed{3600} \text{ s}$$

Answer:

$$\begin{aligned} 1 \text{ h} &= 60 \text{ min} \\ &= 60 \times 60 \text{ s} \\ &= 3600 \text{ s} \end{aligned}$$

Ex 24: Convert 2 hours to seconds:

$$2 \text{ h} = \boxed{7200} \text{ s}$$

Answer:

$$\begin{aligned} 2 \text{ h} &= 2 \times 60 \text{ min} \\ &= 2 \times 60 \times 60 \text{ s} \\ &= 7200 \text{ s} \end{aligned}$$

Ex 25: Convert 1 day to minutes:

$$1 \text{ d} = \boxed{1440} \text{ min}$$

Answer:

$$\begin{aligned} 1 \text{ d} &= 24 \text{ h} \\ &= 24 \times 60 \text{ min} \\ &= 1440 \text{ min} \end{aligned}$$

C.2 CONVERTING INTO MIXED UNITS

Ex 26: Convert 140 seconds into minutes and seconds:

$$140 \text{ s} = \boxed{2} \text{ min} + \boxed{20} \text{ s}$$

Answer: Divide 140 by 60 (since 1 minute = 60 seconds):

$$\begin{array}{r} 2 \\ 60 \overline{)140} \\ \underline{120} \\ 20 \end{array}$$

Quotient is 2, remainder is 20, so:

$$\begin{aligned} 140 \text{ s} &= (2 \times 60 \text{ s}) + 20 \text{ s} \\ &= 2 \text{ min} + 20 \text{ s} \end{aligned}$$

Ex 27: Convert 190 seconds into minutes and seconds:

$$190 \text{ s} = \boxed{3} \text{ min} + \boxed{10} \text{ s}$$

Answer: Divide 190 by 60 (since 1 minute = 60 seconds):

$$\begin{array}{r} 3 \\ 60 \overline{)190} \\ \underline{180} \\ 10 \end{array}$$

Quotient is 3, remainder is 10, so:

$$\begin{aligned} 190 \text{ s} &= (3 \times 60 \text{ s}) + 10 \text{ s} \\ &= 3 \text{ min} + 10 \text{ s} \end{aligned}$$

Ex 28: Convert 395 seconds into minutes and seconds:

$$395 \text{ s} = \boxed{6} \text{ min} + \boxed{35} \text{ s}$$

Answer: Divide 395 by 60 (since 1 minute = 60 seconds):

$$\begin{array}{r} 6 \\ 60 \overline{)395} \\ \underline{360} \\ 35 \end{array}$$

Quotient is 6, remainder is 35, so:

$$\begin{aligned} 395 \text{ s} &= (6 \times 60 \text{ s}) + 35 \text{ s} \\ &= 6 \text{ min} + 35 \text{ s} \end{aligned}$$

Ex 29: Convert 680 minutes into hours and minutes:

$$680 \text{ min} = \boxed{11} \text{ h} + \boxed{20} \text{ min}$$

Answer: Divide 680 by 60 (since 1 hour = 60 minutes):

$$\begin{array}{r} 11 \\ 60 \overline{)680} \\ \underline{60} \\ 80 \\ \underline{60} \\ 20 \end{array}$$

Quotient is 11, remainder is 20, so:

$$\begin{aligned} 680 \text{ min} &= (11 \times 60 \text{ min}) + 20 \text{ min} \\ &= 11 \text{ h} + 20 \text{ min} \end{aligned}$$

Ex 30: Convert 800 minutes into hours and minutes:

$$800 \text{ min} = \boxed{13} \text{ h} + \boxed{20} \text{ min}$$

Answer: Divide 800 by 60 (since 1 hour = 60 minutes):

$$\begin{array}{r} 13 \\ 60 \overline{)800} \\ \underline{60} \\ 200 \\ \underline{180} \\ 20 \end{array}$$

Quotient is 13, remainder is 20, so:

$$\begin{aligned} 800 \text{ min} &= (13 \times 60 \text{ min}) + 20 \text{ min} \\ &= 13 \text{ h} + 20 \text{ min} \end{aligned}$$

Ex 31: Convert 50 hours into days and hours:

$$50 \text{ h} = \boxed{2} \text{ d} + \boxed{2} \text{ h}$$

Answer: Divide 50 by 24 (since 1 day = 24 hours):

$$\begin{array}{r} 2 \\ 24 \overline{)50} \\ \underline{48} \\ 2 \end{array}$$

Quotient is 2, remainder is 2, so:

$$\begin{aligned} 50 \text{ h} &= (2 \times 24 \text{ h}) + 2 \text{ h} \\ &= 2 \text{ d} + 2 \text{ h} \end{aligned}$$

C.3 SOLVING TIME WORD PROBLEMS

Ex 32: Emily has to prepare 42 sandwiches for a party. It takes her 2 minutes to make each sandwich. How long will it take to prepare all the sandwiches?

$$\boxed{1} \text{ hour and } \boxed{24} \text{ minutes}$$

Answer:

- Find the total time in minutes:

$$42 \text{ sandwiches} \times 2 \text{ min per sandwich} = 84 \text{ min}$$

- Convert 84 minutes into hours and minutes:

$$\begin{array}{r} 1 \\ 60 \overline{)84} \\ \underline{60} \\ 24 \end{array}$$

Quotient is 1, remainder is 24, so:

$$\begin{aligned} 84 \text{ min} &= (1 \times 60 \text{ min}) + 24 \text{ min} \\ &= 1 \text{ h} + 24 \text{ min} \end{aligned}$$

- So, Emily needs **1 hour and 24 minutes**.

Ex 33: Amir needs to wrap 80 gifts for a community charity event. It takes him 3 minutes to wrap each gift. How long will it take to wrap all the gifts?

$$\boxed{4} \text{ hours}$$

Answer:

- Find the total time in minutes:

$$80 \text{ gifts} \times 3 \text{ min per gift} = 240 \text{ min}$$

- Convert 240 minutes into hours:

$$\begin{array}{r} 4 \\ 60 \overline{)240} \\ \underline{240} \\ 0 \end{array}$$

Quotient is 4, remainder is 0, so:

$$\begin{aligned} 240 \text{ min} &= 4 \times 60 \text{ min} \\ &= 4 \text{ h} \end{aligned}$$

- So, Amir needs **4 hours**.

Ex 34: Martin needs to write 75 invitations for a wedding. It takes him 3 minutes to write each invitation. How long will it take to write all the invitations?

$$\boxed{3} \text{ hours and } \boxed{45} \text{ minutes}$$

Answer:

- Find the total time in minutes:

$$75 \text{ invitations} \times 3 \text{ min per invitation} = 225 \text{ min}$$

- Convert 225 minutes into hours and minutes:

$$\begin{array}{r} 3 \\ 60 \overline{)225} \\ \underline{180} \\ 45 \end{array}$$

Quotient is 3, remainder is 45, so:

$$\begin{aligned} 225 \text{ min} &= (3 \times 60 \text{ min}) + 45 \text{ min} \\ &= 3 \text{ h} + 45 \text{ min} \end{aligned}$$

- So, Martin needs **3 hours and 45 minutes**.

Ex 35: Su needs to prepare 60 cupcakes for a school event. It takes her 5 minutes to prepare each cupcake. How long will it take to prepare all the cupcakes?

5 hours

Answer:

- Find the total time in minutes:

$$60 \text{ cupcakes} \times 5 \text{ min per cupcake} = 300 \text{ min}$$

- Convert 300 minutes into hours:

$$\begin{array}{r} 5 \\ 60 \overline{)300} \\ \underline{300} \\ 0 \end{array}$$

Quotient is 5, remainder is 0, so:

$$\begin{aligned} 300 \text{ min} &= 5 \times 60 \text{ min} \\ &= 5 \text{ h} \end{aligned}$$

- So, Su needs **5 hours**.

D ADDING AND SUBTRACTING TIME

D.1 ADDING TIME

Ex 36: Add 3 hours 25 minutes and 2 hours 15 minutes:

$$3 \text{ h } 25 \text{ min} + 2 \text{ h } 15 \text{ min} = \boxed{5} \text{ h } \boxed{40} \text{ min}$$

Answer:

- Add the minutes: $25 \text{ min} + 15 \text{ min} = 40 \text{ min}$
- Add the hours: $3 \text{ h} + 2 \text{ h} = 5 \text{ h}$
- Combine and solve:

$$\begin{aligned} 3 \text{ h } 25 \text{ min} + 2 \text{ h } 15 \text{ min} &= (3 \text{ h} + 2 \text{ h}) + (25 \text{ min} + 15 \text{ min}) \\ &= 5 \text{ h} + 40 \text{ min} \\ &= \mathbf{5 \text{ h } 40 \text{ min}} \end{aligned}$$

Ex 37: Add 1 hour 45 minutes and 3 hours 30 minutes:

$$1 \text{ h } 45 \text{ min} + 3 \text{ h } 30 \text{ min} = \boxed{5} \text{ h } \boxed{15} \text{ min}$$

Answer:

- Add the minutes: $45 \text{ min} + 30 \text{ min} = 75 \text{ min}$
- Convert extra minutes: $75 \text{ min} = 60 \text{ min} + 15 \text{ min} = 1 \text{ h} + 15 \text{ min}$
- Add the hours: $1 \text{ h} + 3 \text{ h} + 1 \text{ h} = 5 \text{ h}$

- Combine and solve:

$$\begin{aligned} 1 \text{ h } 45 \text{ min} + 3 \text{ h } 30 \text{ min} &= (1 \text{ h} + 3 \text{ h}) + (45 \text{ min} + 30 \text{ min}) \\ &= 4 \text{ h} + 75 \text{ min} \\ &= 4 \text{ h} + 60 \text{ min} + 15 \text{ min} \\ &= (4 \text{ h} + 1 \text{ h}) + 15 \text{ min} \\ &= \mathbf{5 \text{ h } 15 \text{ min}} \end{aligned}$$

Ex 38: Add 2 minutes 35 seconds and 10 minutes 50 seconds:

$$2 \text{ min } 35 \text{ s} + 10 \text{ min } 50 \text{ s} = \boxed{13} \text{ min } \boxed{25} \text{ s}$$

Answer:

- Add the seconds: $35 \text{ s} + 50 \text{ s} = 85 \text{ s}$
- Convert extra seconds: $85 \text{ s} = 60 \text{ s} + 25 \text{ s} = 1 \text{ min} + 25 \text{ s}$
- Add the minutes: $2 \text{ min} + 10 \text{ min} + 1 \text{ min} = 13 \text{ min}$
- Combine and solve:

$$\begin{aligned} 2 \text{ min } 35 \text{ s} + 10 \text{ min } 50 \text{ s} &= (2 \text{ min} + 10 \text{ min}) + (35 \text{ s} + 50 \text{ s}) \\ &= 12 \text{ min} + 85 \text{ s} \\ &= 12 \text{ min} + 60 \text{ s} + 25 \text{ s} \\ &= (12 \text{ min} + 1 \text{ min}) + 25 \text{ s} \\ &= \mathbf{13 \text{ min } 25 \text{ s}} \end{aligned}$$

Ex 39: Add 5 minutes 20 seconds and 7 minutes 45 seconds:

$$5 \text{ min } 20 \text{ s} + 7 \text{ min } 45 \text{ s} = \boxed{13} \text{ min } \boxed{5} \text{ s}$$

Answer:

- Add the seconds: $20 \text{ s} + 45 \text{ s} = 65 \text{ s}$
- Convert extra seconds: $65 \text{ s} = 60 \text{ s} + 5 \text{ s} = 1 \text{ min} + 5 \text{ s}$
- Add the minutes: $5 \text{ min} + 7 \text{ min} + 1 \text{ min} = 13 \text{ min}$
- Combine and solve:

$$\begin{aligned} 5 \text{ min } 20 \text{ s} + 7 \text{ min } 45 \text{ s} &= (5 \text{ min} + 7 \text{ min}) + (20 \text{ s} + 45 \text{ s}) \\ &= 12 \text{ min} + 65 \text{ s} \\ &= 12 \text{ min} + 60 \text{ s} + 5 \text{ s} \\ &= (12 \text{ min} + 1 \text{ min}) + 5 \text{ s} \\ &= \mathbf{13 \text{ min } 5 \text{ s}} \end{aligned}$$

D.2 SUBTRACTING TIME

Ex 40: Subtract 3 hours 15 minutes from 5 hours 30 minutes:

$$5 \text{ h } 30 \text{ min} - 3 \text{ h } 15 \text{ min} = \boxed{2} \text{ h } \boxed{15} \text{ min}$$

Answer:

- Subtract the minutes: $30 \text{ min} - 15 \text{ min} = 15 \text{ min}$
- Subtract the hours: $5 \text{ h} - 3 \text{ h} = 2 \text{ h}$
- Combine and solve:

$$\begin{aligned} 5 \text{ h } 30 \text{ min} - 3 \text{ h } 15 \text{ min} &= (5 \text{ h} - 3 \text{ h}) + (30 \text{ min} - 15 \text{ min}) \\ &= 2 \text{ h} + 15 \text{ min} \\ &= \mathbf{2 \text{ h } 15 \text{ min}} \end{aligned}$$

Ex 41: Subtract 2 hours 20 minutes from 7 hours 45 minutes:

$$7 \text{ h } 45 \text{ min} - 2 \text{ h } 20 \text{ min} = \boxed{5} \text{ h } \boxed{25} \text{ min}$$

Answer:

- Subtract the minutes: $45 \text{ min} - 20 \text{ min} = 25 \text{ min}$
- Subtract the hours: $7 \text{ h} - 2 \text{ h} = 5 \text{ h}$
- Combine and solve:

$$\begin{aligned} 7 \text{ h } 45 \text{ min} - 2 \text{ h } 20 \text{ min} &= (7 \text{ h} - 2 \text{ h}) + (45 \text{ min} - 20 \text{ min}) \\ &= 5 \text{ h} + 25 \text{ min} \\ &= \mathbf{5 \text{ h } 25 \text{ min}} \end{aligned}$$

Ex 42: Subtract 50 minutes from 2 hours 10 minutes:

$$2 \text{ h } 10 \text{ min} - 50 \text{ min} = \boxed{1} \text{ h } \boxed{20} \text{ min}$$

Answer:

- Subtract the minutes: $10 \text{ min} < 50 \text{ min}$, so borrow 1 hour (60 min): $2 \text{ h } 10 \text{ min} = 1 \text{ h} + 60 \text{ min} + 10 \text{ min} = 1 \text{ h } 70 \text{ min}$, then $70 \text{ min} - 50 \text{ min} = 20 \text{ min}$
- Subtract the hours: $1 \text{ h} - 0 \text{ h} = 1 \text{ h}$ (no hours to subtract)
- Combine and solve:

$$\begin{aligned} 2 \text{ h } 10 \text{ min} - 50 \text{ min} &= 1 \text{ h} + 70 \text{ min} - 50 \text{ min} \\ &= 1 \text{ h} + 20 \text{ min} \\ &= \mathbf{1 \text{ h } 20 \text{ min}} \end{aligned}$$

Ex 43: Subtract 1 hour 20 minutes from 3 hours 10 minutes:

$$3 \text{ h } 10 \text{ min} - 1 \text{ h } 20 \text{ min} = \boxed{1} \text{ h } \boxed{50} \text{ min}$$

Answer:

- Subtract the minutes: $10 \text{ min} < 20 \text{ min}$, so borrow 1 hour (60 min): $3 \text{ h } 10 \text{ min} = 2 \text{ h} + 70 \text{ min}$, then $70 \text{ min} - 20 \text{ min} = 50 \text{ min}$
- Subtract the hours: $2 \text{ h} - 1 \text{ h} = 1 \text{ h}$
- Combine and solve:

$$\begin{aligned} 3 \text{ h } 10 \text{ min} - 1 \text{ h } 20 \text{ min} &= (2 \text{ h} + 70 \text{ min}) - (1 \text{ h} + 20 \text{ min}) \\ &= (2 \text{ h} - 1 \text{ h}) + (70 \text{ min} - 20 \text{ min}) \\ &= 1 \text{ h} + 50 \text{ min} \\ &= \mathbf{1 \text{ h } 50 \text{ min}} \end{aligned}$$

E TIME PROBLEMS

E.1 FINDING TIME DURATIONS

Ex 44: I start playing basketball at 13 : 10 and finish at 15 : 20 in 24-hour format. How long did I play?

$$\boxed{2} \text{ h } \boxed{10} \text{ min}$$

Answer:

- We subtract the start time from the finish time to find the duration of play.
- Subtract the minutes: $20 \text{ min} - 10 \text{ min} = 10 \text{ min}$.
- Subtract the hours: $15 \text{ h} - 13 \text{ h} = 2 \text{ h}$.
- Combine and solve:

$$\begin{aligned} 15 : 20 - 13 : 10 &= (15 \text{ h} - 13 \text{ h}) + (20 \text{ min} - 10 \text{ min}) \\ &= 2 \text{ h} + 10 \text{ min} \\ &= \mathbf{2 \text{ h } 10 \text{ min}} \end{aligned}$$

Ex 45: I start a cooking class at 10 : 45 and finish at 12 : 30 in 24-hour format. How long did the class last?

$$\boxed{1} \text{ h } \boxed{45} \text{ min}$$

Answer:

- We subtract the start time from the finish time to find the duration of the class.
- Subtract the minutes: $30 \text{ min} - 45 \text{ min}$ is not possible, so borrow 1 hour (60 min): $12 \text{ h } 30 \text{ min} = 11 \text{ h } 90 \text{ min}$, then $90 \text{ min} - 45 \text{ min} = 45 \text{ min}$.
- Subtract the hours: $11 \text{ h} - 10 \text{ h} = 1 \text{ h}$.
- Combine and solve:

$$\begin{aligned} 12 : 30 - 10 : 45 &= (12 \text{ h} - 10 \text{ h}) + (30 \text{ min} - 45 \text{ min}) \\ &= 11 \text{ h} + 90 \text{ min} - 10 \text{ h} - 45 \text{ min} \\ &= (11 \text{ h} - 10 \text{ h}) + 45 \text{ min} \\ &= 1 \text{ h} + 45 \text{ min} \\ &= \mathbf{1 \text{ h } 45 \text{ min}} \end{aligned}$$

Ex 46: Albert Einstein was born in 1879. He published his theory of special relativity in 1905. How old was he when he invented this theory?

$$\boxed{26} \text{ years}$$

Answer:

- We subtract the birth year from the year of invention to find his age.
- Subtract the years:

$$\begin{array}{r} 1905 \\ - 1879 \\ \hline 26 \end{array}$$

- He was 26 years old.

Ex 47: Leonardo da Vinci was born in 1452. He began painting the Mona Lisa in 1503. How old was he when he started this painting?

$$\boxed{51} \text{ years}$$



Answer:

- We subtract the birth year from the year he began painting to find his age.
- Subtract the years:

$$\begin{array}{r} 1\ 5\ 10\ 3 \\ - 1\ 14\ 5\ 2 \\ \hline 5\ 1 \end{array}$$

- He was 51 years old.

E.2 SOLVING TIME WORD PROBLEMS

Ex 48: Louis starts his homework at 15 : 30. He spends 1 hour and 45 minutes on math. What time does Louis finish his homework in 24-hour format?

17:15

Answer:

- Add the minutes: $30\text{ min} + 45\text{ min} = 75\text{ min}$
- Convert extra minutes: $75\text{ min} = 60\text{ min} + 15\text{ min} = 1\text{ h} + 15\text{ min}$
- Add the hours: $15\text{ h} + 1\text{ h} + 1\text{ h} = 17\text{ h}$
- Combine and solve:

$$\begin{aligned} 15 : 30 + 1\text{ h } 45\text{ min} &= (15\text{ h} + 1\text{ h}) + (30\text{ min} + 45\text{ min}) \\ &= 16\text{ h} + 75\text{ min} \\ &= 16\text{ h} + 60\text{ min} + 15\text{ min} \\ &= (16\text{ h} + 1\text{ h}) + 15\text{ min} \\ &= \mathbf{17:15} \end{aligned}$$

Ex 49: A train departs from the station at 09 : 40. The journey takes 2 hours and 35 minutes. What time does the train arrive at its destination in 24-hour format?

12:15

Answer:

- Add the minutes: $40\text{ min} + 35\text{ min} = 75\text{ min}$
- Convert extra minutes: $75\text{ min} = 60\text{ min} + 15\text{ min} = 1\text{ h} + 15\text{ min}$
- Add the hours: $9\text{ h} + 2\text{ h} + 1\text{ h} = 12\text{ h}$
- Combine and solve:

$$\begin{aligned} 09 : 40 + 2\text{ h } 35\text{ min} &= (9\text{ h} + 2\text{ h}) + (40\text{ min} + 35\text{ min}) \\ &= 11\text{ h} + 75\text{ min} \\ &= 11\text{ h} + 60\text{ min} + 15\text{ min} \\ &= (11\text{ h} + 1\text{ h}) + 15\text{ min} \\ &= \mathbf{12:15} \end{aligned}$$

Ex 50: Su goes to the cinema. The movie starts at 09 : 15. The travel time from her house is 35 minutes. What time does Su need to leave in 24-hour format?

08:40

Answer:

- To find the departure time, we subtract the travel time from the movie start time because Su needs to arrive by 09 : 15, and the travel time tells us how long it takes her to get there. Subtracting gives us the time she must leave to be on time!
- Subtract the minutes: $15\text{ min} < 35\text{ min}$, so borrow 1 hour (60 min):
 $9\text{ h } 15\text{ min} = 8\text{ h} + 60\text{ min} + 15\text{ min} = 8\text{ h } 75\text{ min}$, then $75\text{ min} - 35\text{ min} = 40\text{ min}$
- Subtract the hours: $8\text{ h} - 0\text{ h} = 8\text{ h}$ (no hours to subtract)
- Combine and solve:

$$\begin{aligned} 09 : 15 - 35\text{ min} &= 8\text{ h} + 75\text{ min} - 35\text{ min} \\ &= 8\text{ h} + 40\text{ min} \\ &= \mathbf{08:40} \end{aligned}$$

Ex 51: A train arrives at the station at 14 : 50. The trip takes 1 hour and 25 minutes. What time did the train depart in 24-hour format?

13:25

Answer:

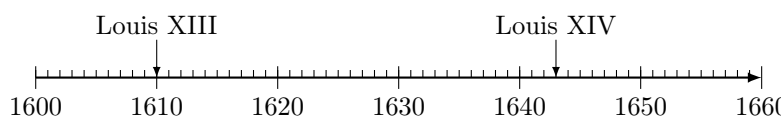
- We subtract the trip time from the arrival time to find the departure time, since the trip duration tells us how long it took to get there.
- Subtract the minutes: $50\text{ min} - 25\text{ min} = 25\text{ min}$
- Subtract the hours: $14\text{ h} - 1\text{ h} = 13\text{ h}$
- Combine and solve:

$$\begin{aligned} 14 : 50 - 1\text{ h } 25\text{ min} &= (14\text{ h} - 1\text{ h}) + (50\text{ min} - 25\text{ min}) \\ &= 13\text{ h} + 25\text{ min} \\ &= \mathbf{13:25} \end{aligned}$$

F TIMELINES

F.1 READING DATES ON A TIMELINE

Ex 52: This timeline shows monarchs of France in the 17th century:



When did Louis XIII begin his reign?

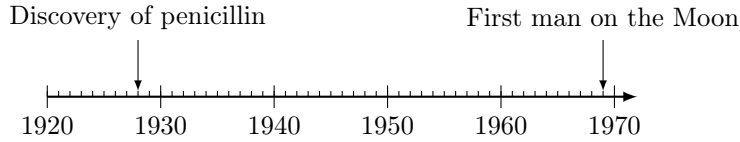
In the year 1610

Answer:

- Look at the timeline: Louis XIII's name points to 1610.
- This marks the start of his reign.
- Final answer: **1610**.

- ☒ 100 BC
- ☐ 27 AD
- ☐ 500 AD

Ex 53: This timeline shows major scientific discoveries in the 20th century:



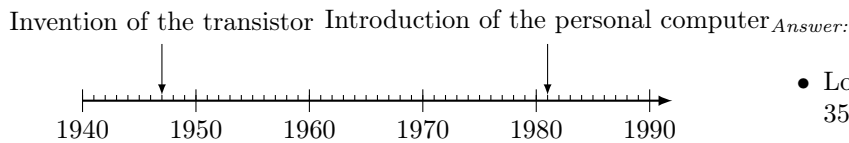
When was penicillin discovered?

In the year

Answer:

- Look at the timeline: “Discovery of penicillin” points to 1928.
- This is the year it happened.
- Final answer: **1928**.

Ex 54: This timeline shows key computing advancements in the 20th century:



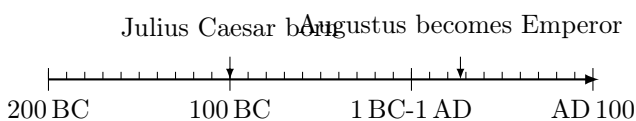
When was the transistor invented?

In the year

Answer:

- Look at the timeline: “Invention of the transistor” points to 1947.
- This is the year it was invented.
- Final answer: **1947**.

MCQ 55: This timeline shows key dates in Roman history:



When was Julius Caesar born?

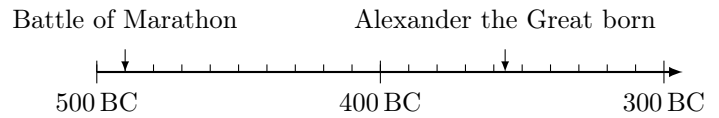
Choose one answer:

- ☐ 200 BC

Answer:

- Look at the timeline: “Julius Caesar born” points to 100 BC.
- This is his birth year.
- Final answer: **100 BC**.

MCQ 56: This timeline shows key events in ancient Greek history:



When was Alexander the Great born?

Choose one answer:

- ☐ 500 BC
- ☐ 490 BC
- ☒ 356 BC
- ☐ 345 BC

- Look at the timeline: “Alexander the Great born” points to 356 BC.
- This is his birth year.
- Final answer: **356 BC**.