

Time: timetables, 12/24-hour clock and time calculations (IGCSE Maths worksheet with answers)

This worksheet covers the time topic in Cambridge IGCSE Mathematics 0580. Read the method notes first, then work through the 20 questions, which get harder as you go. Full worked answers are at the end.

What you need to know

1. Units of time

Time is not a decimal system, so you cannot treat hours and minutes like a decimal number. Learn these facts.

Key facts:

60 seconds = 1 minute

60 minutes = 1 hour

24 hours = 1 day

7 days = 1 week

365 days = 1 year (366 days in a leap year)

To change a decimal number of hours into hours and minutes, multiply the decimal part by 60. To change minutes into a decimal of an hour, divide the minutes by 60.

Worked example 1: Write 2.45 hours in hours and minutes, and write 1 hour 12 minutes in hours.

$0.45 \times 60 = 27$, so 2.45 hours = 2 hours 27 minutes (not 2 hours 45 minutes).

$12 \div 60 = 0.2$, so 1 hour 12 minutes = 1.2 hours.

2. The 12-hour and 24-hour clock

The 12-hour clock uses the numbers 1 to 12 with **am** (midnight to just before noon) and **pm** (noon to just before midnight). The 24-hour clock always uses four digits, from 00:00 to 23:59, and does not need am or pm.

- Morning times: keep the hours, add a leading zero if needed. 7:05 am = 07:05.
- Afternoon and evening times: add 12 to the hours. 4:30 pm = 16:30.
- The hour after midnight: 12:xx am becomes 00:xx. So 12:15 am = 00:15.
- The hour after noon: 12:xx pm stays as 12:xx. So 12:15 pm = 12:15.

To go back from 24-hour to 12-hour clock, reverse the rules: if the hours are 13 or more, subtract 12 and write pm. Midnight is 00:00 in the 24-hour clock (some timetables write the end of a day as 24:00).

Exam tip: in the 24-hour clock always write four digits with a colon (or sometimes no colon, for example 0835). Writing "8:35" or "20:35 pm" will lose the mark.



3. Finding a duration (time taken)

The safest method is to **count on** from the start time: first to the next whole hour, then in whole hours, then the remaining minutes. Add up the pieces at the end. Avoid subtracting times on a calculator: $11:17 - 09:52$ does not give a sensible answer because there are 60 minutes in an hour, not 100.

Worked example 2: A coach leaves at 21:38 and arrives at 04:10 the next day. How long is the journey?

21:38 to 22:00 = 22 minutes

22:00 to 00:00 (midnight) = 2 hours

00:00 to 04:00 = 4 hours

04:00 to 04:10 = 10 minutes

Total = 6 hours 32 minutes.

To find a finishing time, add the hours first, then the minutes, and carry into the next hour whenever the minutes reach 60. If the hours pass 24, subtract 24 and the time is on the next day.

4. Reading timetables

In a bus or train timetable each **column** is usually one journey and each **row** is one stop. Read down a column to follow one bus. To find the next bus after a given time, look along the row for that stop and pick the first time that is later. To arrive by a deadline, look along the row for the destination and pick the latest time that is not after the deadline, then read up that column.

5. Time zones

Different parts of the world use different local times. If place B is n hours **ahead** of place A, then the local time in B is the local time in A plus n hours. If B is behind A, subtract.

For a flight between time zones, work in **one** time zone only. Either change the departure time into the arrival zone, or change the arrival time into the departure zone, then find the flight time.

Worked example 3: Lahore is 4 hours ahead of Paris (in this example). A flight leaves Paris at 11:20 local time and takes 7 hours 25 minutes. Find the arrival time in Lahore.

Arrival in Paris time: $11:20 + 7 \text{ h } 25 \text{ min} = 18:45$.

Lahore is 4 hours ahead: $18:45 + 4 \text{ h} = 22:45$ Lahore time.

Real time differences change when a country uses daylight saving time, so in exams always use the difference given in the question.

6. Speed, distance and time

Formulae:

speed = distance $\div$ time

distance = speed $\times$ time

time = distance $\div$ speed

Average speed = total distance $\div$ total time (including any stops, unless the question says otherwise).

The units must match. If the speed is in km/h, the time must be in hours, so change minutes into a

decimal of an hour first by dividing by 60. To change km/h into m/s, multiply by 1000 and divide by 3600 (or simply divide by 3.6).

Worked example 4: A train travels 117 km in 1 hour 18 minutes. Find its average speed in km/h.

Time = $1 + 18/60 = 1.3$ hours.

Speed = $117 \div 1.3 = 90$ km/h.

On the Extended paper you may also meet **upper and lower bounds**. For the largest possible speed, use the largest possible distance and the smallest possible time.

Questions

1. Write these times in the 24-hour clock.

(a) 7:45 pm; (b) 12:10 am; (c) 11:30 am

2. Write these times in the 12-hour clock, using am or pm.

(a) 15:05; (b) 00:40; (c) 12:25

3. (a) Write 3.4 hours in hours and minutes.

(b) Write 0.15 hours in minutes.

(c) Change three quarters of an hour into seconds.

4. Write 2 hours 50 minutes in hours, as a decimal correct to 3 significant figures.

5. A film starts at 18:35 and lasts 2 hours 48 minutes. At what time does it finish? Give your answer in the 24-hour clock.

6. A bus leaves at 09:52 and arrives at 11:17. Calculate how long the journey takes.

7. A night train leaves at 22:40 and arrives at 06:15 the next morning. Calculate the journey time.

Questions 8 to 10 use this bus timetable.

Stop	Bus A	Bus B	Bus C	Bus D
Ashford	06:45	08:20	10:05	13:50
Bridgeton	07:12	08:47	10:32	14:17
Carlow	07:38	09:13	10:58	14:43
Dunmore	08:05	09:40	11:25	15:10

8. (a) How long does Bus B take to travel from Ashford to Dunmore?

(b) Sara arrives at the Bridgeton stop at 08:30. How long must she wait for the next bus?

(c) Ali is at Carlow and must be in Dunmore by 11:00. Write down the latest time he can catch a bus from Carlow.

9. An extra bus, Bus E, leaves Ashford at 16:35. It takes the same time between stops as the other buses. Write down the times it reaches Bridgeton, Carlow and Dunmore.

10. The road from Ashford to Dunmore is 48 km long. Calculate the average speed of Bus B for the whole journey, in km/h.

11. A car leaves at 10:50 and travels 150 km at an average speed of 60 km/h. At what time does it

arrive?

12. A car travels 210 km in 2 hours 48 minutes. Calculate its average speed in km/h.
13. A runner completes a 10 km race in 42 minutes 30 seconds.
 - (a) Calculate her average speed in km/h, correct to 3 significant figures.
 - (b) Calculate her average speed in m/s, correct to 3 significant figures.
14. Karachi is 5 hours ahead of London. A plane leaves London at 21:30 local time and the flight takes 8 hours 10 minutes. Find the local time in Karachi when the plane lands.
15. Singapore is 4 hours ahead of Dubai. A plane leaves Dubai at 02:55 local time and lands in Singapore at 14:20 local time on the same day. Calculate the flight time.
16. In this question New York is 10 hours behind Karachi. Bilal lives in Karachi. His cousin in New York can take phone calls between 18:00 and 22:00 New York time. Between which Karachi times can Bilal call, and on which day compared with the New York evening?
17. A clock loses 4 seconds every hour. It is set to the correct time at 12:00 noon on Monday. What time does it show at the correct time of 12:00 noon on Thursday?
18. A train 240 m long travels at a constant 72 km/h through a tunnel 1.56 km long. Calculate the time, in minutes and seconds, from the moment the front of the train enters the tunnel to the moment the back of the train leaves it.
19. Hina leaves home at 07:50 and drives 84 km to the city at an average speed of 56 km/h. She spends 2 hours 40 minutes in the city, then drives home along the same road at an average speed of 48 km/h.
 - (a) At what time does she get home?
 - (b) Calculate her average speed for the driving only (the two journeys), correct to 3 significant figures.
20. A cyclist rides 50 km, correct to the nearest kilometre, in 40 minutes, correct to the nearest minute. Calculate the upper bound of her average speed in km/h. Give your answer correct to 1 decimal place.

Answers

1. (a) pm, so add 12 to the hours: $7 + 12 = 19$, giving **19:45**.
(b) 12:xx am is in the hour after midnight: **00:10**.
(c) am, so keep the hours with four digits: **11:30**.
2. (a) $15 - 12 = 3$, so **3:05 pm**.
(b) 00 hours is the hour after midnight: **12:40 am**.
(c) 12 hours is the hour after noon: **12:25 pm**.
3. (a) $0.4 \times 60 = 24$ minutes, so **3 hours 24 minutes**.
(b) $0.15 \times 60 = 9$ minutes.
(c) Three quarters of an hour = 45 minutes; $45 \times 60 = 2700$ seconds.
4. $50 \div 60 = 0.8333\dots$, so 2 hours 50 minutes = $2.8333\dots$ hours = **2.83 hours** (3 s.f.).
5. $18:35 + 2$ hours = 20:35. Then $20:35 + 48$ minutes: $20:35 + 25$ minutes = 21:00, and 23 minutes remain, giving **21:23**.
6. 09:52 to 10:00 = 8 minutes; 10:00 to 11:00 = 1 hour; 11:00 to 11:17 = 17 minutes. Total = 1

hour + 8 + 17 minutes = **1 hour 25 minutes**.

7. 22:40 to 00:00 = 1 hour 20 minutes; 00:00 to 06:00 = 6 hours; 06:00 to 06:15 = 15 minutes.
Total = 7 hours 35 minutes, so **7 hours 35 minutes**.

8. (a) 08:20 to 09:00 = 40 minutes; 09:00 to 09:40 = 40 minutes. Total = **1 hour 20 minutes**.

(b) The Bridgeton row reads 07:12, 08:47, 10:32, 14:17. The first time after 08:30 is 08:47. Wait = 08:47 – 08:30 = **17 minutes**.

(c) In the Dunmore row, Bus B arrives at 09:40 (in time) but Bus C arrives at 11:25 (too late). So Ali must catch Bus B, which leaves Carlow at **09:13**.

9. From the other buses: Ashford to Bridgeton takes 27 minutes (06:45 to 07:12), Bridgeton to Carlow takes 26 minutes (07:12 to 07:38) and Carlow to Dunmore takes 27 minutes (07:38 to 08:05).

Bridgeton: 16:35 + 27 minutes = **17:02**.

Carlow: 17:02 + 26 minutes = **17:28**.

Dunmore: 17:28 + 27 minutes = **17:55**.

10. Time = 1 hour 20 minutes = $1 + \frac{20}{60} = 1.333\ldots$ hours (or $\frac{4}{3}$ hours).

Speed = $48 \div \frac{4}{3} = 48 \times \frac{3}{4} = \mathbf{36 \text{ km/h}}$.

11. Time = $150 \div 60 = 2.5$ hours = 2 hours 30 minutes.

10:50 + 2 hours = 12:50; 12:50 + 30 minutes = **13:20**.

12. Time = $2 + \frac{48}{60} = 2.8$ hours.

Speed = $210 \div 2.8 = \mathbf{75 \text{ km/h}}$.

13. (a) 42 minutes 30 seconds = 42.5 minutes = $42.5 \div 60 = 0.70833\ldots$ hours.

Speed = $10 \div 0.70833\ldots = 14.117\ldots = \mathbf{14.1 \text{ km/h}}$ (3 s.f.).

(b) Distance = 10 000 m. Time = $42 \times 60 + 30 = 2550$ s.

Speed = $10\,000 \div 2550 = 3.921\ldots = \mathbf{3.92 \text{ m/s}}$ (3 s.f.).

14. Work in London time first. 21:30 + 8 hours = 05:30 the next day; 05:30 + 10 minutes = 05:40 London time.

Karachi is 5 hours ahead: 05:40 + 5 hours = **10:40** Karachi time, on the day after departure.

15. Change the arrival time into Dubai time: 14:20 – 4 hours = 10:20 Dubai time.

Flight time = 02:55 to 10:20: 02:55 to 03:00 = 5 minutes; 03:00 to 10:00 = 7 hours; 10:00 to 10:20 = 20 minutes.

Total = **7 hours 25 minutes**.

16. Karachi is 10 hours ahead of New York, so add 10 hours.

18:00 + 10 hours = 28:00, which is 04:00 on the next day.

22:00 + 10 hours = 32:00, which is 08:00 on the next day.

Bilal can call between **04:00 and 08:00 Karachi time**, on the morning of the **day after** the New York evening.

17. Noon Monday to noon Thursday = 3 days = $3 \times 24 = 72$ hours.

Time lost = $72 \times 4 = 288$ seconds = 4 minutes 48 seconds (since $288 - 240 = 48$).

The clock is slow, so it shows 12:00:00 – 4 min 48 s = **11:55:12**, that is 11:55 and 12 seconds am (just before noon).

18. The front must travel the length of the tunnel plus the length of the train for the back to leave.

Distance = $1560 + 240 = 1800$ m.

Speed = $72 \text{ km/h} = 72 \times 1000 \div 3600 = 20 \text{ m/s}$.

Time = $1800 \div 20 = 90 \text{ s} = \mathbf{1 \text{ minute } 30 \text{ seconds}}$.

19. (a) Outward time = $84 \div 56 = 1.5 \text{ hours} = 1 \text{ hour } 30 \text{ minutes}$. She arrives at $07:50 + 1 \text{ h } 30 \text{ min} = 09:20$.

She leaves the city at $09:20 + 2 \text{ h } 40 \text{ min} = 12:00$.

Return time = $84 \div 48 = 1.75 \text{ hours} = 1 \text{ hour } 45 \text{ minutes}$. She gets home at $12:00 + 1 \text{ h } 45 \text{ min} = \mathbf{13:45}$.

(b) Total driving distance = $84 + 84 = 168 \text{ km}$. Total driving time = $1.5 + 1.75 = 3.25 \text{ hours}$.

Average speed = $168 \div 3.25 = 51.69... = \mathbf{51.7 \text{ km/h}}$ (3 s.f.).

Note: this is not the mean of 56 and 48 (which is 52), because she spends longer driving at the slower speed.

20. Upper bound of distance = 50.5 km . Lower bound of time = $39.5 \text{ minutes} = 39.5 \div 60 \text{ hours}$.

Upper bound of speed = largest distance $\div$ smallest time = $50.5 \div (39.5 \div 60) = 50.5 \times 60 \div 39.5 = 3030 \div 39.5 = 76.70...$

Upper bound = $\mathbf{76.7 \text{ km/h}}$ (1 d.p.).