Graphing Proportional Relationships

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Use the axes to name the rate and the input interval the situation permits. For example, $(4, 6)$ means 6 L in 4 minutes on a tank graph, a rate of $6/4 = 1.5$ L per minute. At 8 minutes this gives 12 L if the tank is still filling; do not extend a real graph past its stop time.

Worked example

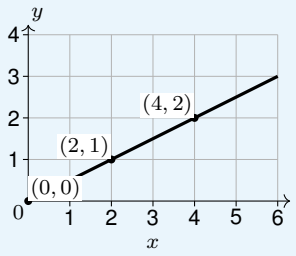
Graph $y = x/2$ from $x = 0$ to $x = 6$ using $(0, 0), (2, 1), (4, 2)$.

1. At $x = 0$, $y = 0/2 = 0$; at $x = 2$, $y = 2/2 = 1$.

2. At $x = 4$, $y = 4/2 = 2$, and the right endpoint has $y = 6/2 = 3$.

3. From $(2, 1)$ to $(4, 2)$ the rise/run is $(2 - 1)/(4 - 2) = 1/2$. Draw the straight segment shown through all three marked points.

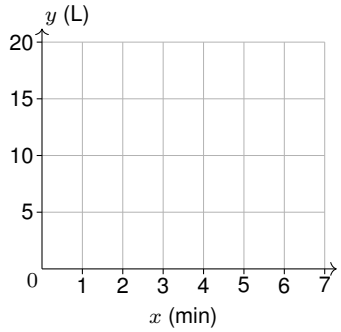
Answer: The straight segment goes through $(0, 0), (2, 1), (4, 2)$ and ends at $(6, 3)$.



Practice Problems

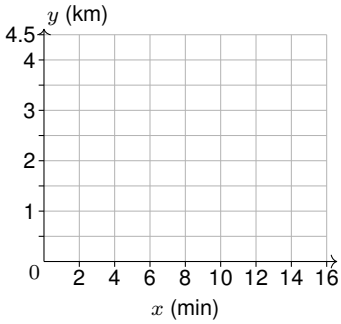
Show your thinking.

1. A pump starts with an empty tank and adds 5 L in 2 minutes at a constant rate. It stops at 15 L. Find the stop time and graph only the filling interval. Mark the measured point and endpoint.



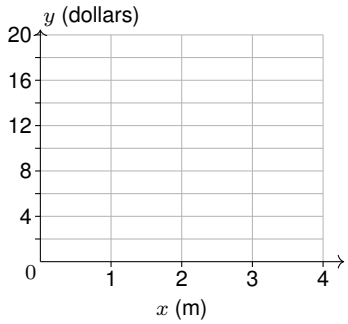
2. A sprinkler starts at zero, uses 7 L in 4 minutes at a constant rate, and runs for only 8 minutes. Is $(12, 21)$ on the extended proportional line? Does it belong to the actual run? Find the total at shutoff.

3. A cyclist travels 1.5 km in 6 minutes at a constant speed from the start. Graph distance for the first 16 minutes. Mark when the cyclist reaches 3.5 km.



4. A constant-speed walking graph passes through the origin and $(2, 7)$, in hours and kilometers. Can the group reach 12 km in 3 hours? Give the shortfall and exact time needed.

5. Shop A charges 7 dollars for 2 m of fabric; B charges 9 dollars for 2 m. Both have constant rates and no fee. Graph and label both costs for lengths 0 to 4 m. Which shop can supply 4 m for at most 16 dollars?



6. Rental A has a straight cost graph through $(0, 4)$ and $(3, 10)$. Rental B has a proportional graph through $(3, 12)$. Inputs are hours and outputs are dollars. Which costs less for 1 hour and for 5 hours, and by how much?

Answer Key

1. Stop at 6 minutes. With x in minutes and y in liters, draw the segment from $(0, 0)$ to $(6, 15)$ through $(2, 5)$.
2. Yes on the extension, no for the actual run. Shutoff total: 14 L.

3. Segment from $(0, 0)$ to $(16, 4)$ through $(6, 1.5)$. Mark $(14, 3.5)$: 14 minutes.

4. No. At 3 hours the group is 1.5 km short. Reaching 12 km takes $24/7$ hours.
5. A: 14 dollars; B: 18 dollars. Only A fits the budget. Draw both segments from the origin.
6. At 1 hour, B costs 2 dollars less. At 5 hours, A costs 6 dollars less.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The rate is $5/2$ L per minute, so the filling rule is $y = (5/2)x$.
2. Time to reach capacity is $15 \div (5/2) = 6$ minutes.
3. The segment passes through $(2, 5)$ and ends at $(6, 15)$. Its input interval is $0 \le x \le 6$ minutes.

Problem 2

1. The line has rate $7/4$ L per minute, and $(7/4)(12) = 21$ L.
2. However, $12 > 8$ minutes, so the point is outside the actual run.
3. The real graph stops at $(8, 14)$ because $(7/4)(8) = 14$ L.

Problem 3

1. From the measured point, speed is $1.5/6 = 1/4$ km per minute.
2. At 16 minutes the distance is $(1/4)(16) = 4$ km; join the origin and $(16, 4)$ through $(6, 1.5)$.
3. The target time is $3.5 \div (1/4) = 14$ minutes. Mark $(14, 3.5)$ within the interval.

Problem 4

1. The walking speed is $7/2$ km per hour.
2. In 3 hours the group walks $(7/2)(3) = 10.5$ km. Shortfall: $12 - 10.5 = 1.5$ km.
3. The target time is $12 \div (7/2) = 24/7$ hours, greater than 3 hours.

Problem 5

1. A has rate $7/2$ dollars per meter, and B has rate $9/2$ dollars per meter.
2. At 4 m, A costs $(7/2)(4) = 14$ and B costs $(9/2)(4) = 18$ dollars. Draw and label the segments from $(0, 0)$ to $(4, 14)$ and $(4, 18)$.
3. Compare $14 \le 16$ and $18 > 16$: A fits the budget, but B does not.

Problem 6

1. A starts at 4 dollars and rises $(10 - 4)/3 = 2$ dollars per hour: $y = 2x + 4$.
2. B starts at zero with rate $12/3 = 4$ dollars per hour: $y = 4x$.
3. At 1 hour A costs $2(1) + 4 = 6$, and B costs $4(1) = 4$. B saves $6 - 4 = 2$ dollars.
4. At 5 hours A costs $2(5) + 4 = 14$, and B costs $4(5) = 20$. A saves $20 - 14 = 6$ dollars.

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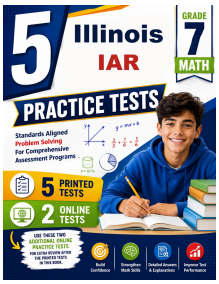

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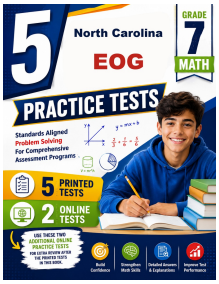

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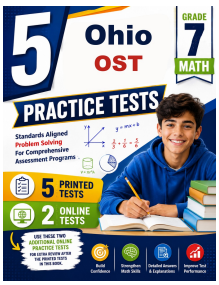

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