



Intermediate Math Circles

October 30, 2013

Problem Set

1. Three bakers: George, Dameon and Lisa have 1.5 hours to make a wedding cake. It usually takes George, Dameon and Lisa 3 hours, 5 hours and 7 hours respectively to complete a wedding cake on their own. If they work together, will they have it done in time?
2. Carly is knitting a scarf. She can complete a scarf in 6 hours, but is interrupted when she is two thirds of the way done. If Melissa, who takes 8 hours to complete a whole scarf, finishes knitting the scarf, what is the total amount of time it would take to complete the scarf?
3. If a car travels at a constant speed of $60 \frac{\text{km}}{\text{h}}$ for 5 s, how many metres does it travel?
4. A car travels 800 m at a constant speed of $80 \frac{\text{km}}{\text{h}}$. Determine the length of time, in seconds, it took the car to travel 800 m.
5. If a car accelerates at a constant rate from $0 \frac{\text{km}}{\text{h}}$ to $60 \frac{\text{km}}{\text{h}}$ in 5 seconds, what distance does it travel in this time?
6. A car travelling at a constant speed of $150 \frac{\text{km}}{\text{h}}$ passes a police cruiser that is stopped on the side of the road. The police cruiser accelerates at a uniform rate of $10 \frac{\text{km}}{\text{h}}$ per second to a top speed of $160 \frac{\text{km}}{\text{h}}$ and chases the car. At what time after the car passed the police cruiser does the police cruiser catch up to the car?
7. **Challenge 1:** A car accelerates at a uniform rate of $4 \frac{\text{m}}{\text{s}^2}$ and brakes at a uniform acceleration rate of $-5 \frac{\text{m}}{\text{s}^2}$. If the car begins and ends at a stop and travels for 60 seconds, what is the maximum speed it can reach, and what distance did it cover?
8. **Challenge 2:** If a car can accelerate at a constant rate of $3 \frac{\text{m}}{\text{s}^2}$ and can brake at a constant acceleration rate of $-5 \frac{\text{m}}{\text{s}^2}$, what is the maximum speed it can reach over a distance of 500 metres if it begins and ends at a stop?

Answers

1. Together they can make the wedding cake in under 1.5 hours (just barely).
2. To complete the scarf it would take 6 hours and 40 minutes.
3. The car travels $\frac{250}{3}$ metres (approximately 83 m).
4. The car travels for 36 seconds.
5. The car travels $\frac{125}{3}$ metres in 5 seconds (approximately 42 m).
6. The police cruiser will catch up to the car in 128 seconds (2 minutes and 8 seconds).
7. The maximum speed is $\frac{400}{3}$ m/s. The car travels 4 kilometres.
8. The maximum speed is $25\sqrt{3}$ m/s.

Full solutions will be posted on the cemc website www.cemc.uwaterloo.ca after the next Math Circles.