



Intermediate Math Circles

October 19, 2011

Rates II

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?

The challenge questions will not be taken up in class but full solutions will be provided.

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?