

1.

2. If we let  $x$  be the rate (in pools per hour) that one pipe fills a pool, then the other pipe fills the pool at a rate of  $1.25x$ . Together they fill the pool in five hours so the rate at which they fill the pool together is  $\frac{1}{5} = 0.2$  pool per hour. From this information we get the following equation:

$$\begin{aligned} x + 1.25x &= 0.2 \\ 2.25x &= 0.2 \\ x &= 0.2 \div 2.25 = \frac{4}{45} \end{aligned}$$

$x = \frac{4}{45}$  pools per hour is the rate of the slower pipe, which is the pipe we are asked about. This means that this pipe fills a pool in  $45 \div 4 = \text{11.25 hours}$ .

3. The large pump and small pump fill a pool at rates of  $\frac{1}{5}$  and  $\frac{1}{6}$  pools per hour respectively. Together, the large and small pump will fill the pool at a rate of  $\frac{1}{5} + \frac{1}{6} = \frac{11}{30}$  pools per hour. For the first hour, only the small pump is turned on, filling  $\frac{1}{6}$  of the pool. At 11 a.m., when the faster pump is also turned on, only  $\frac{5}{6}$  of the pool is left to fill. We divide by the rate to find how many more hours it will take to finish filling the pool:

$$\frac{5}{6} \div \frac{11}{30} = \frac{5}{6} \times \frac{30}{11} = \frac{25}{11} \text{ hours}$$

Multiply by 60 to get minutes:  $\frac{25}{11} \times 60 = 136$  minutes. That is 2 hours and 16 minutes later,

or .

4.

5. The mechanics work at rates of  $\frac{1}{6}$  and  $\frac{1}{8}$  jobs per hour. Together they work at a rate of  $\frac{1}{6} + \frac{1}{8} = \frac{7}{24}$  jobs per hour. They work together for the first two hours, finishing  $2 \times \frac{7}{24} = \frac{7}{12}$  of the job. Then the first guy works alone to finish the rest of the job,  $1 - \frac{7}{12} = \frac{5}{12}$  of the job. It takes him  $\frac{5}{12} \div \frac{1}{8} = \frac{5}{12} \times 8 = \frac{10}{3}$  hours to finish the job. This amounts to  $\frac{10}{3} \times 60 =$

6.

7.



# Math Olympiad and Problem Solving Programs

E120 - Honors Algebra Problem Solving

Problem Set 12.2 - Work

Name:

Date:

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8. Supposed Tom took  $x$  hours to paint the fence by himself. Then Bill took  $x - 12$  hours. Again, we need to find the rate at which they worked. Tom paints  $\frac{1}{x}$  of the fence every hour while Bill paints  $\frac{1}{x-12}$  of the fence every hour. Working together, they paint the fence at a rate of  $\frac{1}{8}$  of the fence every hour.

$$\frac{1}{x} + \frac{1}{x-12} = \frac{1}{8}$$

$$\frac{2x-12}{x^2-12x} = \frac{1}{8}$$

$$16x-96 = x^2-12x$$

$$x^2-28x+96 = 0$$

$$(x-4)(x-24) = 0$$

$$x = 4, 24$$

$x > 12$  since Bill paints the fence in 12 hours less than Tom. Bill: 12 hours, Tom: 24 hours.

9. 2.5 hours

10. 4