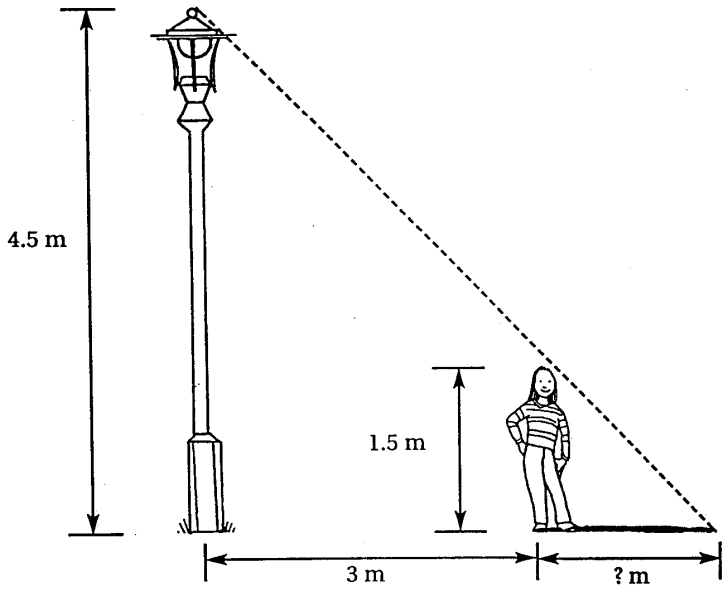
Name Date

Shadows

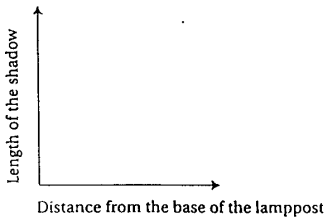
This problem gives you the chance to

- ***use a combination of geometry and algebra to solve an applied problem about shadows***



1. Alice is 1.5 m tall. She is standing 3 m from the foot of a lamppost. The lamp is 4.5 m from the ground. How long will Alice's shadow be?

2. How will the length of Alice's shadow vary as she walks around? Answer this question using a graph. Can you find a formula to fit this graph?



3. Simon is 2 m tall. Suppose you repeated question 2 for Simon. How would his graph compare with the one you drew for Alice? Sketch your ideas and explain your reasoning.

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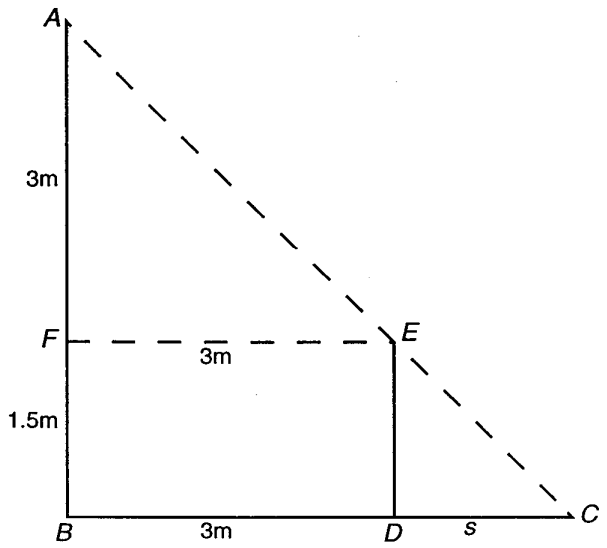
A Sample Solution

Task 13

1.



The lamppost is represented by *AB*, and Alice is represented by *ED*.
Her shadow length is given by *s*.
From the diagram we can see that $\triangle AFE$ is similar to $\triangle EDC$.
Since $\triangle AFE$ is isosceles, so is $\triangle EDC$. This means that $s = 1.5$ m.

2. Let d be Alice's distance from the lamppost as she walks around. Then $BD = FE = d$. Because similar triangles have corresponding sides that are proportional, $\frac{FE}{AF} = \frac{s}{ED}$. Since $AF = 3$ and $ED = 1.5$ (and these values don't change), we see that $s = ED\frac{FE}{AF} = (1.5)\frac{d}{3} = \frac{1}{2}d$. So as Alice walks around, s varies according to the formula $s = \frac{1}{2}d$. Thus the graph should be a straight line through the origin with a slope of $\frac{1}{2}$.

3. The only change for Simon is that his height ED is 2 m, so that AF becomes 2.5 m. Thus the formula becomes $s = ED\frac{FE}{AF} = (2)\frac{d}{2.5} = \frac{4}{5}d$. Hence, s will vary according to the formula $s = \frac{4}{5}d$. His graph will thus be a straight line with a steeper slope (slope = $\frac{4}{5}$) than Alice's graph.