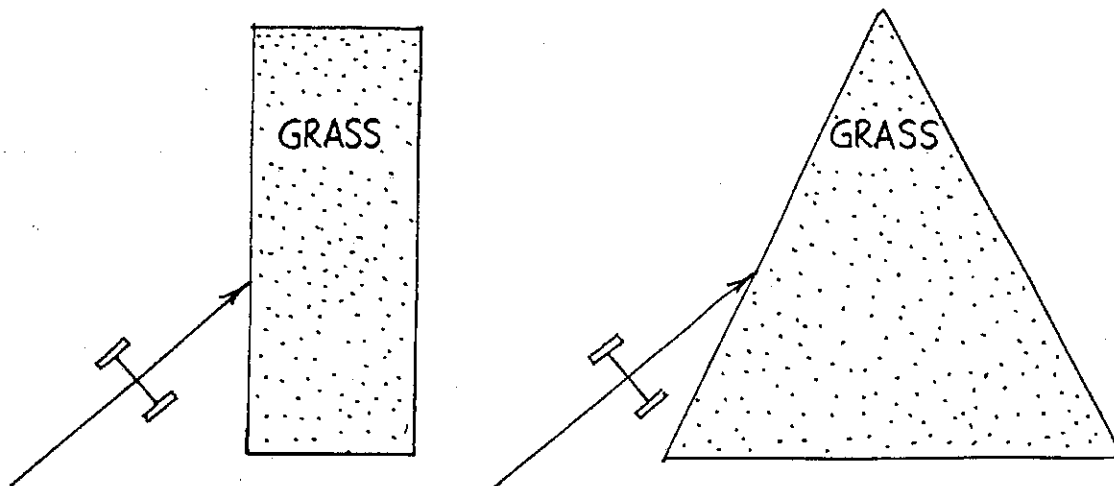
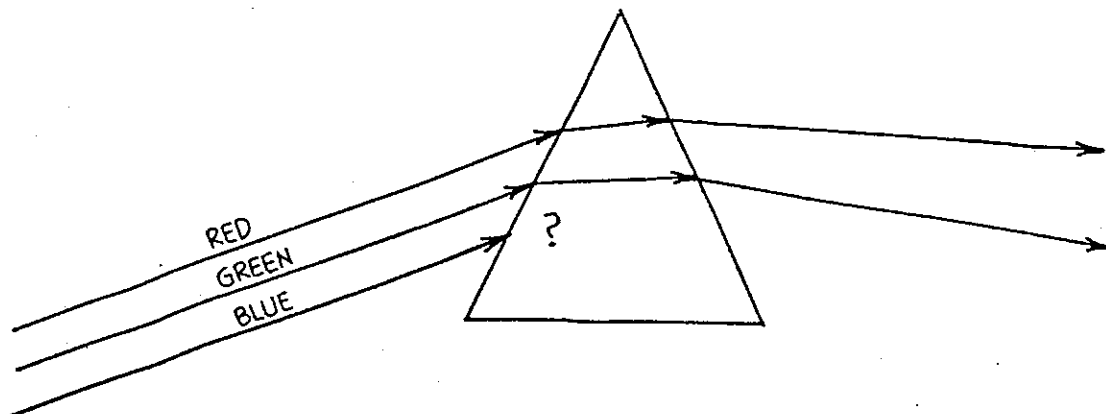


**Concept-Development
Practice Page**
29-3
Refraction

1. A pair of toy cart wheels are rolled obliquely from a smooth surface onto two plots of grass — a rectangular plot as shown at the left, and a triangular plot as shown at the right. The ground is on a slight incline so that after slowing down in the grass, the wheels speed up again when emerging on the smooth surface. Finish each sketch and show some positions of the wheels inside the plots and on the other side. Clearly indicate their paths and directions of travel.



2. Red, green, and blue rays of light are incident upon a glass prism as shown. The average speed of red light in the glass is less than in air, so the red ray is refracted. When it emerges into the air it regains its original speed and travels in the direction shown. Green light takes longer to get through the glass. Because of its slower speed it is refracted as shown. Blue light travels even slower in glass. Complete the diagram by estimating the path of the blue ray.


Conceptual PHYSICS

3. The sketch shows that due to refraction, the man sees the fish closer to the water surface than it actually is.
- Draw a ray beginning at the fish's eye to show the line of sight of the fish when it looks upward at 50° to the normal at the water surface. Draw the direction of the ray after it meets the surface of the water and continues in the air.
 - At the 50° angle, does the fish see the man, or does it see the reflected view of the starfish at the bottom of the pond? Explain.

 - To see the man, should the fish look higher or lower than the 50° path?

 - If the fish's eye were barely above the water surface, it would see the world above in a 180° view, horizon to horizon. The fisheye view of the world above as seen beneath the water, however, is very different. Due to the 48° critical angle of water, the fish sees a normally 180° horizon-to-horizon view compressed within an angle of _____.

