Calculus Review Worksheet

(1) A 13 ft. ladder is leaning against a house when its base begins to slide away from the house at a constant rate of 5 ft/sec. How fast is the top of the ladder sliding down the house at the instant when the bottom of the ladder is 12 ft. from the wall? How fast is the area of the triangle formed by the ladder, wall, and ground changing at the same instant?

(2) The length of a rectangle is increasing at a constant rate of 5 in/sec. The width is decreasing at a constant rate of 4 in/sec. How fast is the area of the rectangle changing at the instant when the width is 15 in. and the length is 20 in.? How fast is the length of each diagonal changing at the same instant?

(3) A water tank is in the shape of a right circular cone with its vertex pointed downward. The radius of the top is 10 feet and the height of the tank is 40 feet. Water is flowing into the tank at a constant rate of 7 $\text{ft}^3/\min$. How fast is the depth of the water rising at the instant when the water is 8 feet deep?

(4) The ends of a trough are equilateral triangles with one vertex pointed downward. The trough is 9 feet long. When the water is 2 feet deep, its depth is increasing at the rate of $\frac{1}{2}$ foot/minute. At what rate is the water flowing into the trough at that moment?

(5) At a certain moment the radius of the base of a right circular cone is 4 in. and is increasing at a constant rate of 5 in/sec, while the height is 3 in. and is decreasing at a constant rate of 6 in/sec. At what rate is the volume increasing or decreasing at that moment?

(6) The hands of a giant clock measure 3 feet and 5 feet. How fast are the tips of the hands approaching each other at exactly 4:00?

(7) Jessica and Karen are running away from each other along paths, which make a 120° angle with each other. Jessica runs at 6 miles/hour while Karen runs at 9 miles/hour. How fast is the distance between them changing 1 hour later?

(8) A 4 foot elf is walking away from a lamppost at 4 ft/sec. The lamppost is 22 feet above the elf's path. How fast is the length of the elf's shadow changing at the instant when the elf is 30 feet from the base of the lamppost? How fast is the tip of her shadow changing at the same instant?

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Answers

(1) -12 ft/sec . $-\dfrac{119}{2}$ ft^2/sec

(2) -5 in^2/sec , $\dfrac{8}{5}$ in/sec

(3) $\dfrac{7}{4\pi}$ ft/min

(4) $6\sqrt{3}$ ft^3/min

(5) increasing at 8π in^3/sec

(6) decreasing at $\dfrac{55\sqrt{3}\pi}{28}$ feet/hour

(7) $3\sqrt{19}$ mph

(8) $\dfrac{8}{9}$ ft/sec , $\dfrac{44}{9}$ ft/sec