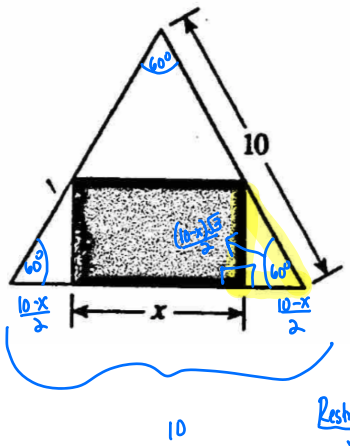
Do Now: #6 from Modeling with Functions Practice Packet 5

6. A rectangle is inscribed in an equilateral triangle, as shown in the diagram below, with a perimeter of 30 cm. Express the area of the rectangle as a function of x.



$A = bh$

$A(x) = x \cdot h$ ← need h in terms of x

$A(x) = x \cdot \frac{(10-x)\sqrt{3}}{2}$, $(0, 10)$

Restrictions

$x > 0$

$x < 10$

Homework 11-14

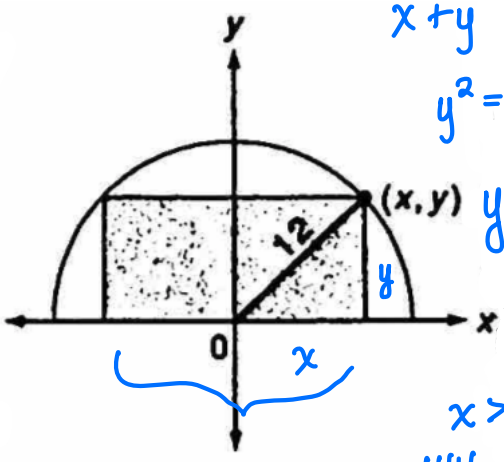
Name: _____ Date: _____

PCH: Modeling with Functions Practice Packet 4 Ms. Loughran

1. A rectangle is inscribed in a semicircle of radius 12 as shown. Express the area of the rectangle as a function of x.

$A = lw$

$A(x) = 2x \cdot \sqrt{144 - x^2}$, $0 < x < 12$



$x^2 + y^2 = 12^2$

$y^2 = 144 - x^2$

$y = \pm\sqrt{144 - x^2}$

$x > 0$

$144 - x^2 > 0$

$-12 \quad 12$

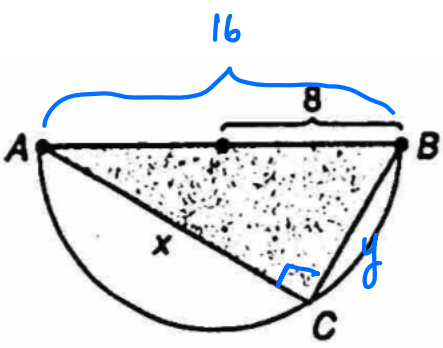
$- \quad + \quad -$

$-12 < x < 12$

2. Triangle ABC is inscribed in a semicircle of radius 8 so that one of its sides coincides with a diameter. Express the area of the triangle as a function of $x = AC$.

$A = \frac{1}{2}bh$

$A(x) = \frac{1}{2}x \cdot \sqrt{256 - x^2}$, $0 < x < 16$



$x > 0$

$256 - x^2 > 0$

$-16 \quad 16$

$-16 < x < 16$

$x^2 + y^2 = 16^2$

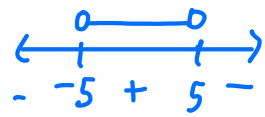
$y^2 = 256 - x^2$

$y = \pm\sqrt{256 - x^2}$

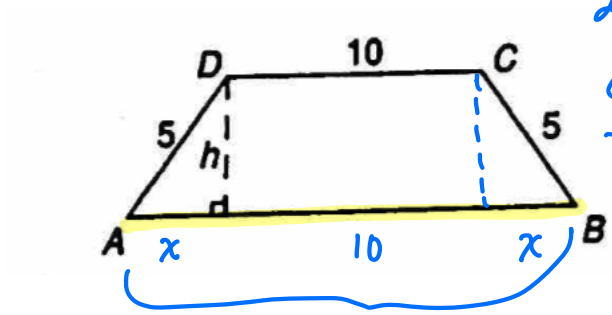
3. *ABCD* is an isosceles trapezoid in which sides *AB* and *DC* are parallel. Express the area of the trapezoid as a function of altitude *h*.

$h > 0$

$25 - h^2 > 0$



$-5 < x < 5$



$A = \frac{1}{2}h(b_1 + b_2)$

$A(h) = \frac{1}{2}h(10 + 10 + 2\sqrt{25 - h^2})$

$A(h) = \frac{1}{2}h(20 + 2\sqrt{25 - h^2})$

$A(h) = 10h + h\sqrt{25 - h^2}$

$0 < h < 5$

$x^2 + h^2 = 5^2$

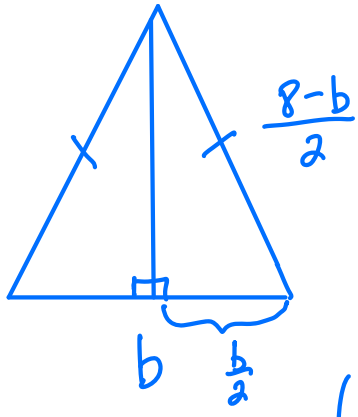
$x^2 = 25 - h^2$

$x = \pm\sqrt{25 - h^2}$

$10 + 2x$

$10 + 2\sqrt{25 - h^2}$

4. An isosceles triangle has a perimeter of 8cm. Express the area *A* of the triangle as a function of the length *b* of the base of the triangle.



$A = \frac{1}{2}bh$

$A(b) = \frac{1}{\cancel{2}}b \cdot (\cancel{2}\sqrt{4 - b})$, $0 < b < 4$

$A(b) = b\sqrt{4 - b}$

$leg = \frac{8-b}{2}$

$\left(\frac{b}{2}\right)^2 + h^2 = \left(\frac{8-b}{2}\right)^2$

$\frac{b^2}{4} + h^2 = \frac{(8-b)^2}{4}$

$h^2 = \frac{(8-b)^2}{4} - \frac{b^2}{4}$

$h^2 = \frac{(8-b)^2 - b^2}{4}$

$h = \pm\sqrt{\frac{(8-b)^2 - b^2}{4}}$

$b > 0$

$4 - b > 0$

$-b > -4$

$b < 4$

$h = \sqrt{\frac{64 - 16b + \cancel{b^2} - \cancel{b^2}}{4}}$

$h = \sqrt{\frac{\cancel{16}^{4}(4-b)}{\cancel{4}}}$

$h = \sqrt{4(4-b)} = 2\sqrt{4-b}$

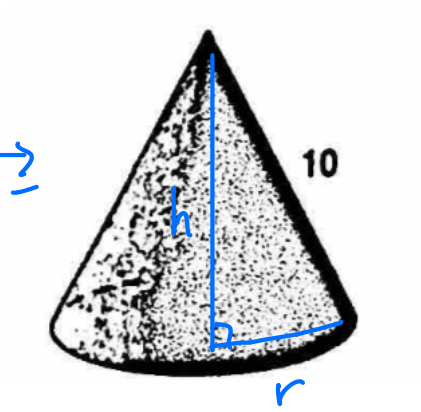
5. The figure shows a right circular cone in which r is the radius of the base, and the slant height is 10. Express the volume of the cone as a function of r.

$r > 0$

$100 - r^2 > 0$

$-10 \quad + \quad 10$

$-10 < r < 10$



$r^2 + h^2 = 10^2$

$h^2 = 100 - r^2$

$h = \pm\sqrt{100 - r^2}$

$V = \frac{1}{3}\pi r^2 h$

$V(r) = \frac{1}{3}\pi r^2 \cdot \sqrt{100 - r^2}, \quad 0 < r < 10$