**Classwork 5**, MATH 1113 Harrison Chapman Name & Time: Key

**1.** If $f(x) = 17 - x^2$, find **and simplify** the following values:

a) $f(a)$

$$\boxed{17 - a^2}$$

b) $f(a+h)$

$$17 - (a+h)^2 = 17 - (a^2 + 2ah + h^2)$$
$$= \boxed{17 - a^2 - 2ah - h^2}$$

c) $f(a) + f(h)$

$$(17 - a^2) + (17 - h^2) = \boxed{34 - a^2 - h^2}$$

d) $\dfrac{f(a+h) - f(a)}{h}$, if $h \neq 0$. (This is called a *difference quotient*.)

$$\frac{(17 - a^2 - 2ah - h^2) - (17 - a^2)}{h} = \frac{17 - a^2 - 2ah - h^2 - 17 + a^2}{h}$$

$$= \frac{-2ah - h^2}{h} = \boxed{-2a - h}$$

**2.** Find the domain of the function $g(x) = \dfrac{\sqrt{3x-2}}{x^2 - 25}$.

domain numerator: $3x - 2 \geq 0$ so $x \geq \frac{2}{3}$

domain denominator: $\mathbb{R}$.

domain fraction: $x^2 - 25 \neq 0$ so $x^2 \neq 25$ so

$x \neq -5$ or $5$.

so: $\boxed{[\frac{2}{3}, 5) \cup (5, \infty)}$

**3.** Units work just like variables: You can only add quantities which have like units; if the units aren't the same, you have to convert all quantities into a common unit before adding.
Add the following quantities together, and be sure to specify the units of your answer.

a) 30 minutes + 15 minutes

$\boxed{45 \text{ minutes}}$

b) 45 minutes + 2 hours

$\frac{3}{4}$ hour 〃 120 minutes 〃 so: $\boxed{2+\frac{3}{4} \text{ hours}}$ or $\boxed{165 \text{ minutes}}$

c) 10 inches + .5 feet

$\frac{10}{12}$ feet 〃 6 inches 〃 so: $\boxed{\frac{16}{12} \text{ feet}}$ or $\boxed{16 \text{ inches}}$

d) 124 centimeters + 2 meters

1.24 meters 〃 200 centimeters 〃 so: $\boxed{3.24 \text{ meters}}$ or $\boxed{324 \text{ centimeters}}$

**4.** When you multiply and divide units, they cancel out just like variables. Multiply the following quantities together, and be sure to specify the units of your answer.

a) $35\frac{\text{meter}}{\text{second}} \times 10 \text{ second}$

$$350 \frac{\text{meter} \cdot \cancel{\text{second}}}{\cancel{\text{second}}} = \boxed{350 \text{ meters}}$$

b) 5 centimeter × 4 centimeter

$\boxed{20 \text{ centimeter}^2}$

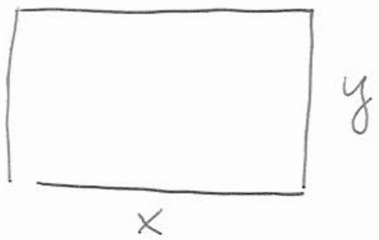
c) $.5\pi\frac{\text{radian}}{\text{minute}} \times \frac{180}{\pi}\frac{\text{degree}}{\text{radian}}$

$\boxed{90 \frac{\text{degrees}}{\text{minute}}}$

d) 6 inch × 3 pound × 1 Ohm

$\boxed{18 \text{ inch} \cdot \text{pound} \cdot \text{ohms}}$

**5.** A rectangle has area $A = 50$ inches$^2$. Express the perimeter $P(x)$ of the rectangle as a function of the length $x$ of the base. What are the units of $P(x)$?




$A = xy$ & $A = 50$ so $50 = xy$

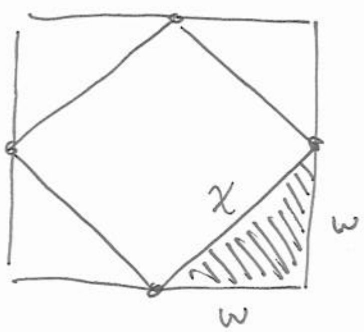
so $y = \frac{50}{x}$.

$P = 2x + 2y$ so $P = 2x + 2\left(\frac{50}{x}\right)$

$\boxed{P(x) = 2x + \frac{100}{x} \text{ inches}}$

**6.** A square is inscribed within another square by connecting the midpoints of the larger square. The edgelength of the inner square is $x$.

a) Express the side, $w$, of the filled-in triangle as a function of $x$.




$w^2 + w^2 = x^2$

$2w^2 = x^2$

$w^2 = x^2/2$

$w = x/\sqrt{2}$ (no − b/c $w \geq 0$ sidelength)

b) Express the area of the outer square as a function of $w$.

$A = (2w)^2$

c) Express the area of the outer square as a function of $x$.

$A = (2w)^2$

$= \left(2\left(\frac{x}{\sqrt{2}}\right)\right)^2 = 4\left(\frac{x}{\sqrt{2}}\right)^2 = 4\frac{x^2}{2}$

$\boxed{A = 2x^2}$

**7.** The point $P(x, y)$ lies on the graph of $y = 5x^3$. Express the distance $d(x)$ from $P$ to the point $Q(0, -6)$ as a function of $x$.

$P(x,y) = P(x, 5x^3)$

$$d(P,Q) = d(x) = \sqrt{(x-0)^2 + (5x^3-(-6))^2}$$

**8.** Two cars leave an intersection at the same time. Alice's car travels south at 65 miles per hour, and Betty's car travels easy at 40 miles per hour.

a) Express the distance $A(t)$ which Alice has driven after $t$ hours of driving as a function of $t$. **Hint.** Use the units to your advantage. If Alice is driving at $65\frac{\text{miles}}{\text{hour}}$ and drives for $t$ hours, what are the units of

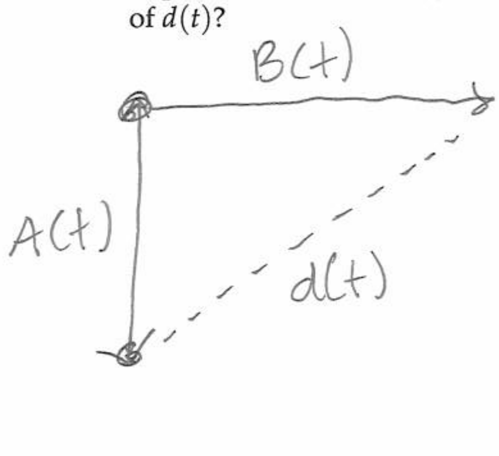
$$65\frac{\text{miles}}{\text{hour}} \times t \text{ hour?}$$

$$A(t) = 65\,\frac{\text{miles}}{\text{hour}} \cdot t \text{ hour} = 65t \text{ miles}$$

b) Express the distance $B(t)$ which Betty has driven after $t$ hours of driving as a function of $t$.

$B(t) = 40t$ miles

c) Express the distance $d(t)$ between Alice and Betty's cars after $t$ hours of driving. What are the units of $d(t)$?




$$d(t) = \sqrt{(65t)^2 + (40t)^2}$$
miles.