1. The graph of a function f is shown below. Find the following:

   a) $f(1)$ and $f(5)$

   $f(1) = 3 \qquad f(5) = -0.7$

   b) the domain of f
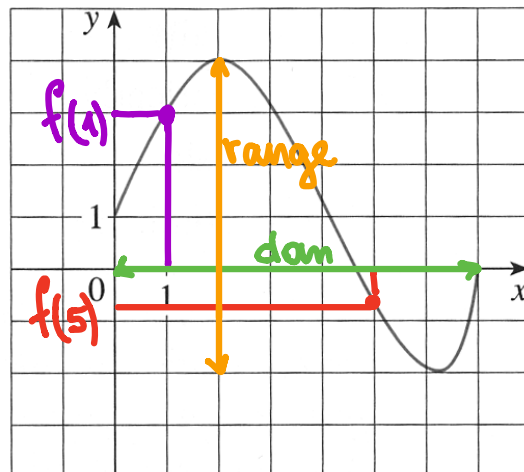
   $\text{Dom}(f) = [0, 7]$

   c) the range of f

   $E(f) = [-2, 4]$

   d) For which value of x is $f(x) = 4$?

   $x = 2$

   e) Where is f increasing?

   $[0, 2] \cup [6.1, 7]$

2. Let $f(x) = 3x^2 - x + 2$. Find and simplify the following expressions. Are (b) and (c) different?

   (a) $f(2)$

   $f(2) = 3 \cdot 2^2 - 2 + 2 = \boxed{12}$

   (b) $f(a^2)$

   $f(a^2) = 3(a^2)^2 - a^2 + 2 = \boxed{3a^4 - a^2 + 2}$

   (c) $[f(a)]^2$

   $(f(a))^2 = (3a^2 - a + 2)^2 = 9a^4 + a^2 + 4 - 6a^3 + 12a^2 - 4a$

   (d) $\dfrac{f(a+h) - f(a)}{h} = \dfrac{3(a+h)^2 - (a+h) + 2 - 3a^2 + a - 2}{h} =$

   $= \dfrac{3a^2 + 6ah + 3h^2 - a - h + 2 - 3a^2 + a - 2}{h} = \dfrac{6ah + 3h^2 - h}{h} =$

   $= \dfrac{h(6a + 3h - 1)}{h} = \boxed{6a + 3h - 1}$

3. Determine whether each of the following functions is even, odd, neither even nor odd:

(a) $f(x) = \cos(x) + x^6$ <u>even</u>

$f(x)$ is even if $f(-x) = f(x)$
$f(x)$ is odd if $f(-x) = -f(x)$

$f(-x) = \cos(-x) + (-x)^6 =$
$= \cos x + x^6$

(b) $f(x) = \sin(x) - x^3$ <u>odd</u>

$f(-x) = \sin(-x) - (-x)^3 = -\sin x + x^3$

(c) $f(x) = x - x^2$ <u>neither even nor odd</u>

$f(-x) = -x - (-x)^2 = -x - x^2$

4. Find the domain of each of the following functions. Use interval notation.

(a) $f(x) = \dfrac{1}{x^2 - 16}$ (rational function)

$x^2 - 16 \neq 0$
$x^2 \neq 16 \implies x \neq \pm 4$

$\text{Dom}(f) = (-\infty, -4) \cup (-4, 4) \cup (4, \infty)$

(b) $g(x) = \ln(x - 4)$

$x - 4 > 0 \implies x > 4$

$\text{Dom}(g) = (4, \infty)$

5. Graph the piecewise defined function.
$$f(x) = \begin{cases} x + 1 & \text{if } x \leq -1 \\ x^2 & \text{if } x > -1 \end{cases}$$