

Homework Set 1 (Due in class on Thursday, Sep. 17)
(late papers accepted until 1:00 Friday)

1. a) Describe (and sketch) the real numbers x that satisfy $|x - 2| < 3$.
b) Sketch the points (x, y) in the plane where $|x - y| > 1$.
2. a) How many real roots does $x^4 + x^2 - 2x + 2 = 0$ have?
b) Find all points (x, y) in the plane that satisfy $x^2 - 2xy + 5y^2 = 0$.
3. Show that $\sqrt{7 + 2\sqrt{6}} - \sqrt{7 - 2\sqrt{6}} = 2$.
4. Solve $\log_9(5 - 3x) = -1/2$ for x .
5. Let $A = (-6, 3)$, $B = (2, 7)$, and C be the vertices of a triangle. Say the altitudes through the vertices A and B intersect at $Q = (2, -1)$. Find the coordinates of C .
[The *altitude* through a vertex of a triangle is a straight line through the vertex that is perpendicular to the opposite side – or an extension of the opposite side.]
6. Let $y = f(x)$ describe a smooth curve in the plane ($-\infty < x < \infty$) that does not pass through the origin. Say the point $P = (a, b)$ on the curve is closest to the origin. Show that the straight line from the origin to P is perpendicular to the curve.
7. Let $f(x)$ be a continuous function that satisfies $\int_0^x f(t)dt = c - \cos(x^2)$. Find the function $f(t)$ and the constant c .
8. a) Prove that the product of two odd integers is also odd.
b) If $k > 0$ is an integer, is $k(k + 1)(k + 2)$ always divisible by 6?
9. List these numbers from smallest to largest:

$$2^{121} \quad 9^{55} \quad 7^{88} \quad u_0,$$

where $u_0 :=$ number of seconds since the birth of our universe.

[Last revised: September 13, 2009]