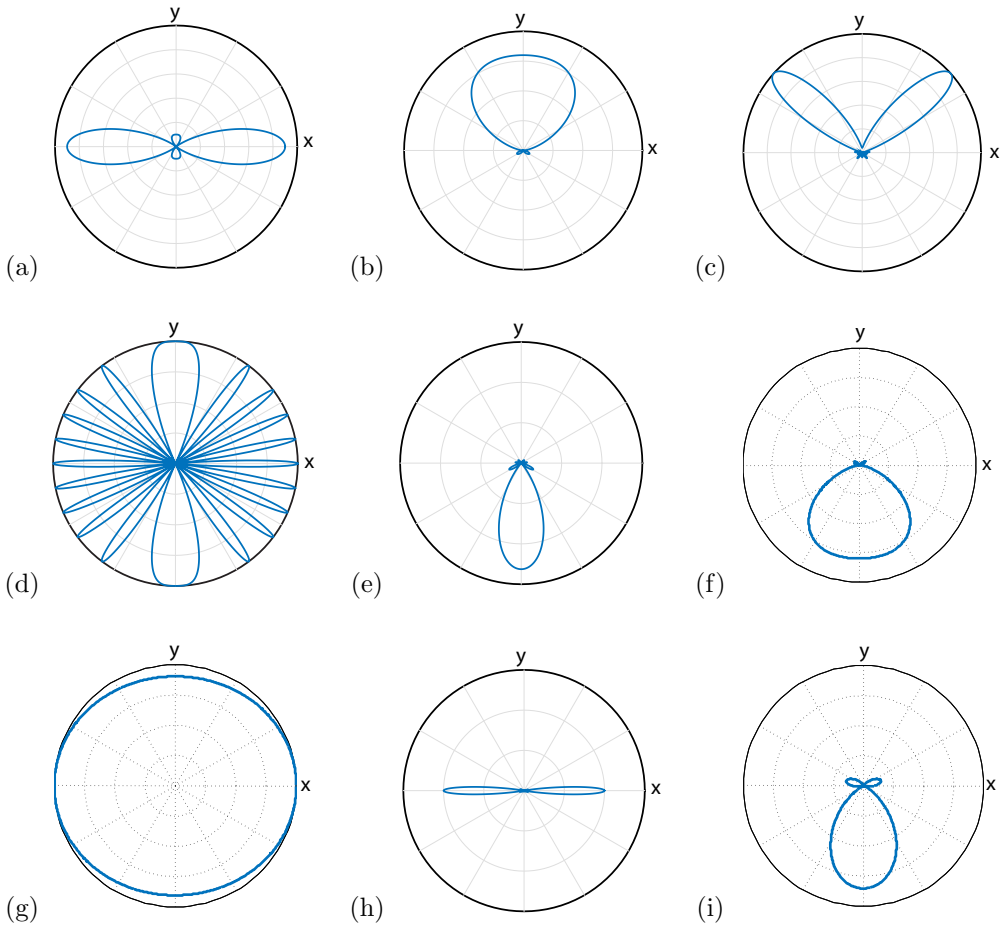
ECE 4370: Antenna Engineering
Solutions to TEST 2 (Spring 2015)

1. **Uniform Linear Antenna Arrays:**



(1) b: $N = 4$, $\beta = -90°$, $d = \frac{\lambda}{4}$ (ordinary endfire)

(2) f: $N = 4$, $\beta = +90°$, $d = \frac{\lambda}{4}$ (ordinary endfire)

(3) _____ $N = 5$, $\beta = -120°$, $d = \frac{\lambda}{2}$

(4) a: $N = 3$, $\beta = 0°$, $d = \frac{\lambda}{2}$

(5) i: $N = 4$, $\beta = 112.5°$, $d = \frac{3\lambda}{16}$ (Hansen-Woodward endfire)

(6) e: $N = 8$, $\beta = 101.75°$, $d = \frac{7\lambda}{32}$ (Hansen-Woodward endfire)

(7) d: $N = 2$, $\beta = 0°$, $d = 5\lambda$

(8) h: $N = 10$, $\beta = 0°$, $d = \frac{\lambda}{2}$

Apologies, as this problem had several typos in it whose corrections didn't recomplie in Latex. The graders were extra lenient and ommitted some blanks.

2. **Small-Scale Fading:**

   (a) 1.5 %

   (b) 0.66 %

   (c) add an extra antenna

3. **Design of a Helical Antenna:**

   (a) 16.7 cm

   (b) 40.2°

   (c) 2.25 GHz $\leq f \leq$ 4.0 GHz

4. **Horn or Yagi?:**

   (a) Y: You need to put a directional antenna high on a thin, steerable mast with minimal wind shear forces.

   (b) H: You need to make a directional antenna that operates at 20 GHz.

   (c) Y: You need to make a directional antenna that operates at 300 MHz.

   (d) H: You need to make an antenna that operates at 2 GHz with 9 dBi of peak gain and *maximal* bandwidth.

   (e) Y: You need to make an antenna named after a Japanese professor.