Show all work for full credit. No calculators, books or notes are allowed. The point value of each problem is given in the margin.

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<td>12</td>
<td>20</td>
<td>21</td>
<td>11</td>
<td>100</td>
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SHOW YOUR WORK CLEARLY.

\[
\sin^2 x = \frac{1}{2} (1 - \cos 2x)
\]
1. Express the following polar equations in terms of rectangular coordinates.
   
   a. $\theta = \pi/2$

   b. $r = \cos \theta$

2. Find the area inside both of the circles $r = \cos \theta$ and $r = \sin \theta$. 
(12) 3. Find an equation of the parabola with focus (-2,0) and directrix $x = 2$.

(12) 4. Find an equation of the hyperbola with center (-1,3), vertices (1,1) and (1,-5), and asymptotes $3x - 2y = 7$ and $3x + 2y = 7$. 
(20) 5. Determine whether the given sequence \( \{a_n\} \) converges, and find its limit if it does.

(a) \( a_n = 2 \) for all \( n \).

(b) \( a_n = (-1)^n \)

(c) \( a_n = \frac{1}{n} \cos \frac{1}{n} \)

(d) \( a_n = \left(1 + \frac{1}{n}\right)^n \)
(21) 6. Determine whether the given infinite series converges or diverges. If it converges, find its sum. (Pay attention to where the series starts).

(a) \[ \sum_{n=1}^{\infty} \left(\frac{2}{3}\right)^n \]

(b) \[ \sum_{n=0}^{\infty} \frac{1^n + 3^n}{2^n} \]

(c) \[ 1 - \frac{2}{3} + \frac{4}{9} - \frac{8}{27} + \ldots \]

(11) 7. Find the MacLaurin series (i.e. the Taylor series with \( a = 0 \)) for \( f(x) = e^{2x} \).