1. (a)For $\alpha > 0$, use a trigonometric substitution to show that $\int \frac{1}{\sqrt{\alpha^2+x^2}}dx = \ln|x + \sqrt{\alpha^2 + x^2}| + C$.
   (b)Let $m \neq n$ be positive integers. Calculate the integral $\int (\sin mx)(\sin nx)dx$.
2. Suppose that the real numbers α and β are not both zero, then identify the curve $r = \alpha\cos\theta + \beta\sin\theta$ and find the equation in rectangular coordinates for it.
3. Sketch the curves $r = 1 - \cos\theta$ and $r = 1 + \sin\theta$ and find the points at which they intersect.
4. Find the area outside $r = \cos 2\theta$, but inside $r = 1$.
5. Find the tangent(s) to the curve $x(t) = t\sin\frac{\pi t}{2}$, $y(t) = t^3 - t$ at the point $(1, 0)$.
6. Determine whether the tangent line at $[0, 0]$ of the curve $r = 1 - \cos\theta$, $\theta \in [-\pi, \pi]$ exist or not?
7. Write the polar equation $r^2 = \sin\theta$ in rectangular coordinates.
8. Let $x = x(t)$ be continuous on [c,d] with $x(t) \in [a, b]$ for $t \in [c, d]$, $x(c) = a$ and $x(d) = b$. Let $y = f(x)$ be a function on [a,b]. If $y = f(x) = f(x(t))$, as a function of t, is continuous on [c,d], then $y = f(x)$, as a function of x, is continuous on [a,b].