You have 10 minutes to complete the quiz. Calculators are not permitted, and remember to show your calculations and explain your reasoning in order to receive full credit.

1. Use a double integral in polar coordinates to find the volume of the solid below the paraboloid $z = 18 - 2x^2 - 2y^2$ and above the xy-plane.

   We need to find the bounds of the domain, so look for where the paraboloid intersects the xy-plane (at $z=0$): if $0 = 18 - 2x^2 - 2y^2$ then $x^2 + y^2 = 9$, so in polar coordinates we should integrate up to $r = 3$:

   \[
   \int_{\theta=0}^{2\pi} \int_{r=0}^{3} (18 - 2r^2) r \, dr \, d\theta = 2\pi \int_{r=0}^{3} (18r - 2r^3) \, dr
   \]
   \[
   = 2\pi \left[9r^2 - \frac{1}{2}r^4\right]_{r=0}^{3}
   \]
   \[
   = 2\pi (81 - 81/2)
   \]
   \[
   = 81\pi.
   \]