## 20 October 2014 Linear Approximation and Differentials

(1) Use linear approximation to estimate the given number.
(a) $\tan ^{-1}(0.1)$
(b) $\ln 2.6$ (hint: $e \approx 2.7$ )
(c) $\sqrt{122}$
(2) Find an approximation for $\sqrt{2} \sin \left(\frac{5 \pi}{16}\right)$ in terms of $\pi$.
(3) Verify that $\sqrt[4]{1+2 x} \approx 1+\frac{1}{2} x$ when $x$ is near 0 .
(4) Use differentials to estimate the amount of paint needed to apply a coat of paint 0.05 cm thick to a hemispherical dome with diameter 50 m .
(5) Use differentials to find a formula for the approximate volume of a thin cylindrical shell with height $h$, inner radius $r$, and thickness $d r$.

