32A Killip Homework 7 Due Friday, Dec. 1.

- Section 15.5: 32, 34, 58.
- Consider the surface $z^2 = 1 + x^2 + y^2$.
  (a) Find all points on the surface where the tangent plane is perpendicular to
  $$\begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix}$$
  (b) Find all points on the surface whose tangent plane passes through $(0, 0, 1/2)$.
- Section 15.6: 4, 13, 20, 21, 30, 44, 46.
- Compute all partial derivatives of
  $$F(x, y, z) = \int_x^y \frac{e^{zs^2} - 1}{s}\, ds$$
  and so determine
  $$\frac{d}{dt} \int_t^{2t} \frac{e^{ts^2} - 1}{s}\, ds$$
- Section 15.7: 4, 12, 24, 26.
- In class, we introduced the paraboloid of best approximation to $f(x, y)$ at $(0, 0)$ as
  $$p(x, y) = f(0, 0) + \nabla f(0, 0) \cdot \begin{pmatrix} x \\ y \end{pmatrix} + \tfrac{1}{2} \frac{\partial^2 f}{\partial x^2}(0, 0)\, x^2 + \frac{\partial^2 f}{\partial x \partial y}(0, 0)\, xy + \tfrac{1}{2} \frac{\partial^2 f}{\partial y^2}(0, 0)\, y^2$$
  Show that for any vector $\vec{u} = \left(\begin{smallmatrix} a \\ b \end{smallmatrix}\right)$ we have
  $$\left.\frac{d}{dt}\right|_{t=0} f(t\vec{u}) = \left.\frac{d}{dt}\right|_{t=0} p(t\vec{u})$$
  and
  $$\left.\frac{d^2}{dt^2}\right|_{t=0} f(t\vec{u}) = \left.\frac{d^2}{dt^2}\right|_{t=0} p(t\vec{u})$$
  Hint: Problem 15.6.46, assigned earlier, helps with the latter.