- The domain of the function
$$\mathbf{r}(t) = \langle t^2, \sqrt{t-1}, \sqrt{5-t} \rangle$$

- $$\lim_{t \to 1} \left(\sqrt{t+3}\mathbf{i} + \frac{t-1}{t^2-1}\mathbf{j} + \frac{\tan t}{t}\mathbf{k} \right)$$

- A parametric equation for the line segment that joins (0,0,0) to (1,2,3).

- A Daily Double! Sketch the curve with the equation $\mathbf{r}(t) = \langle t, \cos 2t, \sin 2t \rangle$.

- The time at which the following two particles collide, if they do indeed collide; for $t \geq 0$, their paths are given by
$$\mathbf{r}_1(t) = \langle t^2, 7t{-}12, t^2 \rangle \quad \mathbf{r}_2(t) = \langle 4t{-}3, t^2, 5t{-}6 \rangle$$

- The derivative of $\mathbf{r}(t) = \langle \cos t, \sin t \rangle$.

- The derivative of $\mathbf{r}(t) = e^{t^2}\mathbf{i} - \mathbf{j} + \ln(1 + 3t)\mathbf{k}$.

- The unit tangent vector of the path $\mathbf{r}(t) = \cos t\mathbf{i} + 3t\mathbf{j} + 2\sin 2t\mathbf{k}$ when $t = 0$.

- The parametric equations for the tangent line to the curve with the parametric equations

$$x = e^{-t}\cos t,\ \ y = e^{-t}\sin t,\ \ z = e^{-t}$$

at the point (1,0,1).

- $\int (e^t\mathbf{i} + 2t\mathbf{j} + \ln t\mathbf{k})dt$

- $f(2,-1,6)$ where $f(x,y,z) = e^{\sqrt{z-x^2-y^2}}$.

- The approximate value for $f(-3,3)$ given the contour map for f below:

- (A Daily Double!) Sketch the graph of $f(x,y) = 1 - x^2$.

- The contour map of $f(x,y) = x - y^2$ showing the level curves $z = -2,-1,0,1,2$.

- A thin metal plate, located in the xy-plane, has temperature $T(x,y)$ at the point (x,y). The level curves of T are called *isothermals* because at all points on an isothermal the temperature is the same. Sketch some isothermals if the temperature function is given by

$$T(x,y) = 100/(1 + x^2 + 2y^2)$$

- $$\lim_{(x,y)\to(0,0)} \frac{x^2}{x^2+y^2}$$

- $$\lim_{(x,y,z)\to(3,0,1)} e^{-xy}\sin(\pi z/2)$$

- The points at which the function $F(x,y) = \sin(xy)/(e^x - y^2)$ is continuous.

- The value of
$$\lim_{(x,y)\to(0,0)} (x^3+y^3)/(x^2+y^2)$$
(hint: use polar coordinates).

- The value of
$$\lim_{(x,y,z)\to(0,0,0)} \frac{xyz}{x^2+y^2+z^2}$$
(hint: use spherical coordinates).

- The partial derivatives $f_x(x,y)$ and $f_y(x,y)$ of the function $f(x,y) = xe^{3y}$.

- The partial derivative $f_z(x,y,z)$ of the function $f(x,y,z) = xy^2z^3 + 3yz$

- The partial derivative $\partial z/\partial x$ of the implicitly defined function $x^2+y^2+z^2 = 3xyz$.

- The second partials u_{xx}, u_{yy}, and u_{zz} of the function $u = 1/\sqrt{x^2+y^2+z^2}$. (Hint: they satisfy the three-dimensional Laplace equation $u_{xx} + u_{yy} + u_{zz} = 0$.)

- (A Daily Double!) The kinetic energy of a body with mass m and velocity v is $K = \frac{1}{2}mv^2$. Show that

$$\frac{\partial K}{\partial m}\frac{\partial^2 K}{\partial v^2} = K$$

- The equation of the tangent plane to the surface $z = 4x^2 - y^2 + 2y$ at the point (-1,2,4).

- The equation of the tangent plane to the surface $z = y\cos(x-y)$ at the point (2,2,2).

- The differential of $u = e^t \sin\theta$.

- The differential of $w = \ln\sqrt{x^2+y^2+z^2}$.

- The estimated maximum error in calculating the area of a rectangle of length 30 cm and width 24 cm (with an error at most 0.1 cm in each), using differentials.

- The derivative dz/dt where

$$z = x^2y + xy^2,\ x = 2 + t^4,\ y = 1 - t^3$$

- The derivative dw/dt where

$$w = xe^{y/z},\ x = t^2,\ y = 1 - t,\ z = 1 + 2t$$

- The partial derivative $\partial z/\partial s$ where $z = e^r \cos\theta,\ r = st,\ \theta = \sqrt{s^2 + t^2}$.

- The partial derivative $\partial u/\partial \theta$, where

$$u = x^2 + yz,\ x = pr\cos\theta,\ y = pr\sin\theta$$

and $z = p + r$ when $p = 2,\ r = 3,\ \theta = 0$.

- (A Daily Double!) The rate at which the temperature is rising on the bug's path after 3 seconds, where the bug is crawling along the path

$$x = \sqrt{1+t},\ y = 2 + \frac{1}{3}t$$

(x and y are measured in cm) starting at $t = 0$ seconds, and the temperature $T(x, y)$ at the point (x, y) satisfies $T_x(2, 3) = 4$ and $T_y(2, 3) = 3$.

- The directional derivative of $f(x, y) = \sqrt{5x - 4y}$ at the point (4,1) in the direction $\theta = -\pi/6$.

- The gradient of $f(x, y, z) = xe^{2yz}$.

- The directional derivative of the function $f(x,y) = 1 + 2x\sqrt{y}$ at the point (3,4) in the direction of the vector $\langle 4, -3 \rangle$.

- The equation of the tangent plane the surface $x^2 + 2y^2 + 3z^2 = 21$ at the point (4,-1,1).

- The points on the hyperboloid $x^2 - y^2 + 2z^2 = 1$ where the normal line is parallel to the line that joins the points (3,-1,0) and (5,3,6).

- A pentagon is formed by placing an isosceles triangle on a rectangle, as shown in the figure. If the pentagon has fixed perimeter P, find the lengths of the sides of the pentagon that maximize the area of the pentagon.