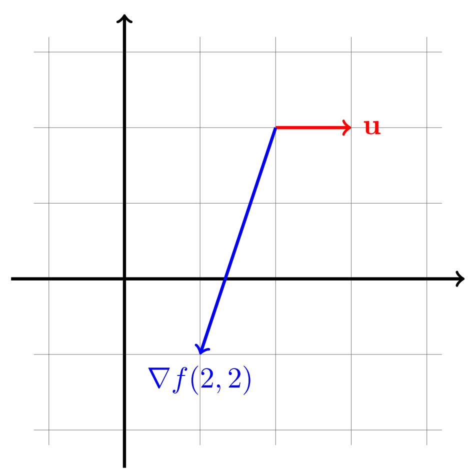
Math 242 **Midterm 3 Review**

1. Find the tangent plane to $f(x, y) = 4x^3y^2 + 2y$ at $(1, -2, 12)$
2. Find f_{xx}, f_{xy} and f_{yy} for $f(x, y) = \sin(2x) - xe^{3y} + y^2$.
3. The Wind-Chill Index is a function $W = W(T, v)$ where T is the air temperature outside and v is the velocity of the wind. W represents how cold air feels when it blows on exposed skin. Is $\partial W/\partial T$ positive or negative? Explain. What about $\partial W/\partial v$?
4. The pressure, volume, and temperature of 1 mole of gas are related by the equation $PV = 8.3T$. If the volume is decreasing at -0.4 L/sec and the temperature is increasing at 0.5 K/sec, how fast is the pressure (in kilopascals) changing with respect to time when the volume is 10 liters and the temperature is 200 Kelvin.
5. If $z = f(x, y)$ is a smooth function (all partial derivatives are continuous) and f has a local maximum at (2,1) where $z = 5$, what is the tangent plane to the surface at that point?
6. Let $f(x, y) = x^2 + \sin(xy)$.
   (a) Find ∇f at $(1, 0)$.
   (b) Find $D_u f$ at $(1, 0)$ when $u = (\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$
7. Use the figure below to estimate $D_u g(2, 2)$.



8. The function $f(x, y) = 3x - 2y^2 + y^4$ has six critical points: $(1, 0)$, $(1, 1)$, $(1, -1)$, $(-1, 0)$, $(-1, 1)$ and $(-1, -1)$. For each critical point, use the second derivative test to determine whether it is a local max/min or a saddle point.
9. The total resistance of two electrical resistors connected in parallel is

$$R = \left(\frac{1}{R_1} + \frac{1}{R_2}\right)^{-1}.$$

The resistances are measured in ohms as $R_1 = 25\Omega$ and $R_2 = 50\Omega$ with a possible error of 2% in each case (so $R_1 = 25 \pm 0.5$ and $R_2 = 50 \pm 1.0$). Use differentials to estimate the maximum error in the computed value of R.