Calculus 3 Notes

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1 Section 13.2

1.1 Ideal Projectile Motion

If v_0 makes an angle α with the horizon, then

$$v_0 = (|v_0|\cos\alpha)\hat{\imath} + (|v_0|\sin\alpha)\hat{\jmath}$$

Also, assume $r_0 = 0\hat{\imath} + 0\hat{\jmath}$. With these formulas it can be derived that

$$r(t) = -\frac{1}{2}gt^2\hat{\jmath} + v_0 t$$

2 Section 14.6

2.1 Standard Linear Approximation

For $f(x, y)$ at (x_0, y_0), the Standard Linear Approximation of $f(x, y)$ is:

$$L(x, y) = f(x_0, y_0) + f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0) \tag{2.1.1}$$

2.2 The Error in the Standard Linear Approximation

If f has continuous first and second partial derivative throughout an open set containing a rectangle R centered at (x_0, y_0) and if M is any upper bound for the values of $|f_{xx}|, |f_{yy}|$, and $|f_{xy}|$ on R, then the error $E(x, y)$ incurred in replacing $f(x, y)$ on R by its linearizion satisfies the inequality

$$|E(x, y)| \leq \frac{1}{2}M(|x - x_0| + |y - y_0|)^2. \tag{2.2.1}$$

2.3 Tangent Plane

For $f(x, y)$ at (x_0, y_0), the tangent plane of $f(x, y)$ is:

$$f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0) \tag{2.3.1}$$

If you have a surface $z = f(x, y)$ at $P(x_0, y_0, z_0)$ use

$$f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0) - (z - z_0) = 0 \tag{2.3.2}$$

2.4 Normal Line

The normal line to $f(x, y, z)$ at $P_0(x_0, y_0, z_0)$ has the following equations:

$$x = x_0 + f_x(P_0)t$$
$$y = y_0 + f_y(P_0)t$$
$$z = z_0 + f_z(P_0)t$$