

Notes for Chapter 24 Exam

Prof. Townsend Fall 2011

On the exam you may use the calculator for all calculations. Be sure to tell me what your use so you can get partial credit if there is an error. Button press information is fine. e.g. F2/1 tells me you took a derivative.

1) Tangents and Normals

$$m_{\text{tan}} = -\frac{1}{m_{\perp}}$$

$$m_{\text{tan}} = \left. \frac{dy}{dx} \right|_{x=x_0} \quad \text{where the point } (x_0, y_0) \text{ is the point of tangency (or normalcy)}$$

You will always need to find $\frac{dy}{dx}$ to find m_{tan} , m_{\perp} , or (x_0, y_0) .

TI-89:

Check your answer by graphing. On the TI-89, go to F5/A to graph the tangent line when looking at a graph. Graph the normal line as a new y function. ZoomSqr makes the x and y graph spacing the same so the normal looks perpendicular to the curve and its tangent.

2) Velocity and Acceleration

$$v_x = \frac{dx}{dt} \quad v_y = \frac{dy}{dt}$$

$$a_x = \frac{dv_x}{dt} \quad a_y = \frac{dv_y}{dt}$$

If you are given $y = f(x)$ and v_x , then you will need the chain rule to find

$$v_y = \frac{dy}{dt} = \frac{dy}{dx} \frac{dx}{dt} = \frac{dy}{dx} v_x$$

TI-89:

$$d(y(t), t) \text{ gives } v_y = \frac{dy}{dt}$$

$$d(x(t), t) \text{ gives } v_x = \frac{dx}{dt}$$

$$d(y(t), t, 2) \text{ gives } a_y = \frac{d^2y}{dt^2}$$

$$d(x(t), t, 2) \text{ gives } a_x = \frac{d^2x}{dt^2}$$

$[x(t), y(t)]$ is the position vector

$d([x(t), y(t)], t)$ gives the velocity vector

$d([x(t), y(t)], t, 2)$ gives the acceleration vector

$[f(x), g(y)] \triangleright$ *polar* gives the answer in cylindrical coordinates. Use degree mode. \triangleright *polar* is in the Catalog in the p 's.

3) Related Rates

You will need to use the chain rule in order to relate two rates.

Assume you are given $y = f(x)$ and you are interested in relating time derivatives

$$\frac{dx}{dt} \text{ and } \frac{dy}{dt}.$$

Then you will need

$$\frac{dy}{dt} = \left(\frac{dy}{dx} \right) \left(\frac{dx}{dt} \right)$$

Volume and area formulas are on the inside of the front flap of your book.

4) Max/Min problems

You must show the first and second derivative on the exam even though you found them on the TI-89.

Prove that a function is maximum or minimum by looking at its second derivative.

Find the location of the maximum or minimum by setting the first derivative to zero.

You may **graph the function** to show you are right. Be careful of what window you choose. It probably would be wise to actually graph the function first so you know if you are getting the right answer as well as where to look for the answer.

When there are two equations, solve for one of the variables in the equation *not* being maximized or minimized then plug it into the equation that *is* being maximized or minimized. Then take the derivatives of that equation as described above. In word problems the graph window is not always obvious.