I. FIND EACH LIMIT. IF A LIMIT FAILS TO EXIST, STATE THAT FACT.
IF A LIMIT VALUE IS ∞ OR $-\infty$, STATE THAT FACT.

1. $\lim_{x\to 4} \dfrac{x^2-5x+4}{x^2-x-12}$

2. $\lim_{x\to(-2)} f(x)$ where $f(x)=\begin{cases} -4x-x^2 & \text{if} \quad x\le -2 \\ \dfrac{15}{x+5} & \text{if} \quad x>-2 \end{cases}$

II. USING A $\delta - \varepsilon$ PROOF, PROVE THE FOLLOWING STATEMENTS.

3. $\lim_{x\to 2}(5x-1)=9$

III. FIND THE DERIVATIVE OF EACH FUNCTION. YOU **NEED <u>NOT</u> SIMPLIFY** YOUR RESULT.

4. $f(x)=\dfrac{x^2+5}{x^5+2}$

5. $f(x)=\left(x^{-5}+x^{-2}\right)^3$

6. $f(x)=x^4\sec(x)$

7. $f(x)=x^4e^{\sin(x)}$

8. $f(x)=\sin^2(x^2)$

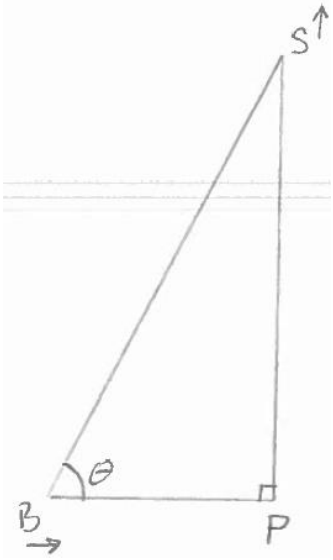
9. $f(x)=\ln\left(\ln(x^2)\right)$

IV. USE IMPLICIT DIFFERENTIATION TO FIND $\dfrac{dy}{dx}$.

10. $x^2+5x^2y+y^4=3-\cos(y)$

V. USE THE METHODS DISCUSSED IN CLASS TO SOLVE.

11. SUPERMAN IS FLYING UP VERTICALLY AT THE RATE OF 24 $\frac{m}{s}$. BATMAN IS DRIVING TOWARD THE POINT LABELED *P* (SEE FIGURE) DIRECTLY BELOW SUPERMAN AT THE RATE OF 8 $\frac{m}{s}$. LABEL BATMAN'S ANGLE OF ELEVATION AS θ. WHAT IS THE RATE OF CHANGE OF BATMAN'S ANGLE OF ELEVATION WHEN SUPERMAN IS 120 METERS HIGH AND BATMAN IS 30 METERS FROM POINT *P* ?



VI. FIND THE ABSOLUTE EXTREMA FOR THE GIVEN FUNCTION ON THE GIVEN CLOSED INTERVAL.

12. $f(x) = x^3 - 6x^2 + 15$ on $[-2,1]$

VIII. FIND EACH INDEFINITE OR DEFINITE INTEGRAL.

13. $\int (24x^2 \sin(x^3))\, dx$

14. $\int \frac{\ln(x)}{4x}\, dx$

15. $\int e^x \tan(e^x) dx$

16. $\int 24x^2 (e^{x^3-3}) dx$

17. $\int \frac{e^{5x}}{5+5e^{5x}}\, dx$

18. $\int \frac{\sec(x)\tan(x)}{\sqrt{1-\sec(x)}}\, dx$

19. $\int_1^e \frac{1}{x\,(1+\ln(x))}\, dx$

20. $\int_0^{\pi/4} (1-\cos(2x))\, dx$