
Read each problem carefully. Please show all your work for each problem!
Use only those methods discussed thus far in class. No calculators!

1. (20 points) Differentiate:

$$(a) f(z) = \frac{\cos z}{2 - \sin z}, \quad (b) g(x) = \tan(\sqrt{1+x^2}),$$
$$(c) h(y) = (\cos 2y)^2(\sec 2y)^3, \quad (d) p(t) = \frac{\cot t}{t}.$$

2. (16 points) For the curve

$$y = x^2\sqrt{9-x^2},$$

find all the points at which the tangent line is either horizontal or vertical.

3. (16 points) Find the absolute minimum and absolute maximum values of the function on the given interval:

$$f(x) = 2x^3 - 3x^2 - 12x + 1, \quad [-2, 3].$$

4. (16 points) Find the dimensions of the rectangle of largest area that has its base on the x -axis and its other two vertices above the x -axis and lying on the parabola $y = 8 - x^2$.
5. (16 points) Use implicit differentiation to compute dy/dx , if

$$xy + 2x + 3x^2 = 4.$$

Now compute dy/dx by explicitly solving for y in terms of x first and then differentiating the obtained function. Show that these two answers agree.

6. (16 points) A boat leaves a dock at 2:00PM and travels due south at a speed of 40 km/h. Another boat has been heading due east at 30 km/h and reaches the same dock at 3:00PM. What was the rate of change of distance between the two boats at 2:30PM?