

Exam 2 -- MTH 229-01
May 23, 2008

*Show your work and/or reasoning on all problems unless otherwise instructed.
All work must be on separate sheets of paper. Keep this question sheet.
There are 110 points available, but the exam is based on a scale of 100 points.*

- (40) **1.** Find the derivative of each function. Treat any letters other than the independent variable as constants.
- (a) $f(x) = \frac{\sin(x)}{a + cx^2}$ (b) $h(x) = \ln\left(\frac{b}{x}\right)$
- (c) $g(t) = t^3 e^{-2t}$ (d) $q(t) = \cot^2(\sqrt{t})$
- (20) **2.** On what interval(s) is the function $f(x) = xe^{-2x}$ increasing? On what interval(s) is $f(x)$ concave up?
- (20) **3.** Suppose a curve is given by the equation $x^2 \cos(y) = xy + 1$.
- (a) Use implicit differentiation to find $\frac{dy}{dx}$.
- (b) Find the equation of the tangent line to the curve at the point $(1, 0)$.
- (15) **4.** A particle is moving along the curve $y = \sqrt{x}$. As the particle passes through the point $(4, 2)$, its x -coordinate increases at a rate of 3 cm/sec. How fast is the distance from the particle to the origin changing at this instant?
- (15) **5.** Derive (i.e. prove) the derivative formulas for $\tan(x)$ and $\arctan(x)$. You may use the derivative rules for $\sin(x)$ and $\cos(x)$.