

**MAT 1303 –Midterm**  
**March 4, 2004**

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(1) Find the tangent line at  $(1, f(1))$  of  $f(x) = 3(x^2 - 2)^3$ .

(2) Use implicit differentiation to find  $\frac{dy}{dx}$  of the equation  $x^3 + xy + y^2 = 4$ , and evaluate the derivative at the point  $(0, 2)$ .

(3) Find

$$\int \frac{dx}{x^2 - x - 2}$$

(4) Determine whether or not each of the following improper integrals converge. If it does, evaluate it.

(a)

$$\int_0^{\infty} \frac{dx}{e^{3x}}.$$

(b)

$$\int_0^8 \frac{dx}{\sqrt{8-x}}.$$

(5) Find the centre and the radius of the sphere  $x^2 + y^2 + z^2 - 8y = 0$ .

(6) Let  $f(x, y) = x^2 - 3xy - y^2$ .

(a) Find the partial derivatives  $f_x$  and  $f_y$ .

(b) Examine the function for relative extrema and saddle points.