Calculators and mobile phones are not allowed.

Answer all of the following questions.

1. [6 points each] Evaluate the following integrals:

(a) $$\int \frac{2x^2+3}{x^3+x^2+4x+4}\,dx$$

(b) $$\int \frac{x}{\sqrt{x^2-4x+5}}\,dx$$

(c) $$\int \cos 2x \cos 4x\,dx$$

(d) $$\int x^3 \tan^{-1}(x^2)\,dx$$

(e) $$\int \frac{dx}{\sqrt{x}+\sqrt[3]{x}}$$

2. [6 points] Determine whether the following integral converges, if it converges, find its value.

$$\int_{-\infty}^{\infty} \sin^2 x\,dx$$

3. [2+5 points] Let C be the curve given by the parametric equations

$$x = 2\tan t, \qquad y = \tan^2 t; \quad 0 \le t \le \pi/3.$$

(a) Find the slope of the tangent line at the point on the curve C that corresponds to $t = \pi/4$.

(b) Find the length of the curve C.

4. [4+3 points] Let R be the region outside the curve $r = 1$ and inside the curve $r = 2\sin 3\theta$.

(a) Sketch the region R.

(b) Find the area of the region R.