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**Q1.** (15p) Let

$$f(t) = \begin{cases} \frac{2x-4}{x^2-4}, & x < 2 \\ b, & x = 2 \\ \sqrt{ax^3 - \frac{3}{4}}, & x \geq 2 \end{cases}$$

- a) If  $\lim_{x \rightarrow 2} f(x)$  exists find the value of  $a$ .  
b) If  $f(x)$  is continuous at  $x = 2$  find the value of  $b$ .

**Q2.** (13p) Find the limit  $\lim_{x \rightarrow \infty} x^{1/x}$ .

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**Q3.** (15p) Find  $\frac{dy}{dx}$  for the following,

a)  $y = \sqrt[3]{x^2} + \sin^{-1}(x) + e^{\tan x}$ ,      b)  $y = \int_0^{x^3} \sqrt{1+t^2} dt$ .

**Q4.** (14p) Find the volume of the solid generated by revolving the region bounded by  $y = 1 - x$  and  $y = 1 - x^2$  about the  $y$ -axis.

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**Q5.** (14p) Sketch the region  $R$  enclosed by the curve  $y = x^2 + 1$  and the lines  $x = -1$ ,  $y = x + 1$ . Find the area of the region  $R$ .

**Q6.** (14p) Find the volume of the solid generated by revolving the region bounded by  $y = x^2 + 2$  and  $y = x + 4$  about the  $x$ -axis.

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**Q 7.** (15p) Evaluate the following integrals,

a)  $\int_0^{\pi/4} \tan x \, dx$ ,      b)  $\int \cos^2(x) \, dx$ ,      c)  $\int e^{2x} \, dx$ .

