MATH 3B Final practice problems

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1. Compute the following:
   (a) $\int e^{-x}\cos(2x)\,\mathrm{d}x$
   (b) $\int \frac{1+x^2}{\sqrt{3x+x^3}}\,\mathrm{d}x$
   (c) $\int \cos(\sqrt{x})\,\mathrm{d}x$
   (d) $\frac{d}{dx}\int_x^{x^2} t^3\,\mathrm{d}t$
   (e) $\int \frac{(ln(x))^3}{x}\,\mathrm{d}x$
   (f) $\int \frac{x^3-\sqrt{x}}{x^2}\,\mathrm{d}x$
   (g) $\int \sin^3(x)\cos^2(x)\,\mathrm{d}x$
   (h) $\int_0^1 \frac{4}{4x-1}\,\mathrm{d}x$
   (i) $\int \frac{1}{x^2-1}\,\mathrm{d}x$
   (j) $\int \tan^5(x)\sec^7(x)\,\mathrm{d}x$
   (k) $\int \frac{\sqrt{9-x^2}}{x^2}\,\mathrm{d}x$
   (l) $\int \frac{x-4}{x^2-5x+6}\,\mathrm{d}x$
2. Show that the region $R = \{(x,y) : x \geq 1, 0 \leq y \leq 1/x\}$ has infinite area.
3. Find the average value of $f(x) = \frac{x}{x-6}$ for $0 \leq x \leq 2$.
4. Find the volume of the solid obtained by rotating the region bounded by the curves $y = 2x$ and $y = x^2$ about the x-axis.
5. Let $f(x) = x^2$. Approximate $\int_0^4 x^2\,\mathrm{d}x$ using a right hand Riemann sum and 4 subintervals.
6. A honeybee population starts with 100 bees and increases at a rate of $n'(t)$ bees per week. What does $100 + \int_0^4 n'(t)\,\mathrm{d}t$ represent?
7. Find the work required to lift a chain lying on the ground to a height of 10 feet if the chain weighs 20 pounds and is 10 feet long.