Five pages, seven questions, 60 points total.

Some problem-solving hints:

1. Don't panic.
2. If you're stuck, at least try *something*.
3. If you can't do something, don't.
4. If things gets weird, there's probably a mistake.
5. If you can't solve a problem, solve an easier problem first.
6. When in doubt, write it out.
7. Remember: $(a+b)^2 \neq a^2 + b^2$.
8. If a method doesn't help, admit it.
9. No work – no credit.

**Problem 1** (2 points each)**.** *Evalute the integrals:*

*(a)* $\int_{-1}^{1}(x^3 - 2x)dx$

*(b)* $\int_{1}^{9} \frac{x-1}{\sqrt{x}}dx$

*(c)* $\int_{e}^{e^4} \frac{dx}{x \ln x}$

*(d)* $\int(\sin\theta + x^5 + 3)d\theta$

**Problem 2** (5 points)**.** *Compute* $\frac{d}{dx}\int_{\sqrt{x}}^{2x} \arctan t \; dt$*.*

**Problem 3** (15 points)**.** *Suppose $S$ is a solid described as follows. The base of $S$ is a disk of radius 2. The cross-sections of $S$ perpendicular to the $x$-axis are equilateral triangles.*

*(a) Draw $S$ (including the base and cross sections).*

*(b) Compute the volume of $S$.*

**Problem 4** (10 points)**.** *A spring has a natural length of* $20cm$*. If a* $25N$ *force is required to keep it stretched to a length of* $30cm$*, how much work is required to stretch it from* $20cm$ *to* $25cm$*?*

**Problem 5** (5 points)**.** *Compute the average value of*

$$f(x) = \frac{1}{-\sqrt{1-x^2}}$$

*on the interval* $[0, 1]$*.*

**Problem 6** (6 points)**.** *Use a left Riemann sum with* $n = 3$ *to approximate*

$$\int_1^4 x^x dx.$$

**Problem 7** (6 points)**.** *Compute the area bounded by* $y = \sin(x)$ *and* $y = \cos(x)$ *between* $x = \pi/4$ *and* $x = 5\pi/4$*.*