

Five pages, six 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). *Evaluate the integrals:*

(a) $\int_{-1}^1 (x^4 - 3x) dx$

(b) $\int_0^1 (1 - x)^9 dx$

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

(d) $\int (\frac{1}{x} + x^5 + 3) dx$

Problem 2 (5 points). *Compute $\frac{d}{dx} \int_{x^4}^0 \cos^2 \theta d\theta$.*

Problem 3 (15 points). Consider the region R between the curves $y = x^2$ and $y = x$. Let S be the solid created by rotating R around the line $x = -1$.

(a) Draw R and S .

(b) Set up an integral to compute the volume of S , using the disk/washer method.

(c) Set up an integral to compute the volume of S , using the cylinder method.

(d) Compute the volume of S using one of the above integrals.

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 (12 points). *The tank shown below is full of water. Find the work required to pump the water out of the spout if $r = 6$ m and $h = 2$ m.*

