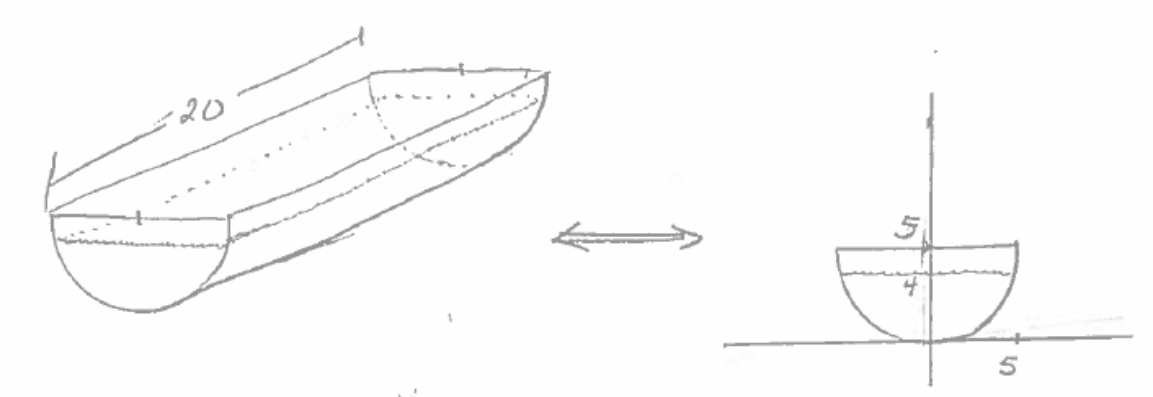
Note that the numbering of the items is haphazard as these were copied and pasted from several exams.

I. IF 320 UNITS OF WORK STRETCHES AS SPRING 16 CENTIMETERS. SET UP **AND EVALUATE** THE INTEGRAL WHICH WILL FIND THE AMOUNT OF WORK DONE STRETCHING THE SPRING 13 CENTIMETERS, STARTING FROM REST..

II. A TROUGH IS 20 FT LONG AND ITS ENDS ARE IN THE SHAPE OF A SEMICIRCLE WITH RADIUS 4 FT, AS SHOWN. A LIQUID WITH DENSITY CONSTANT OF δ FILLS THE TROUGH TO A DEPTH OF 3 FT. SET UP AN INTEGRAL WHICH WILL COUMPUTE THE AMOUNT OF WORK DONE EMPTYING THE LIQUID OVER THE TOP OF THE TROUGH.

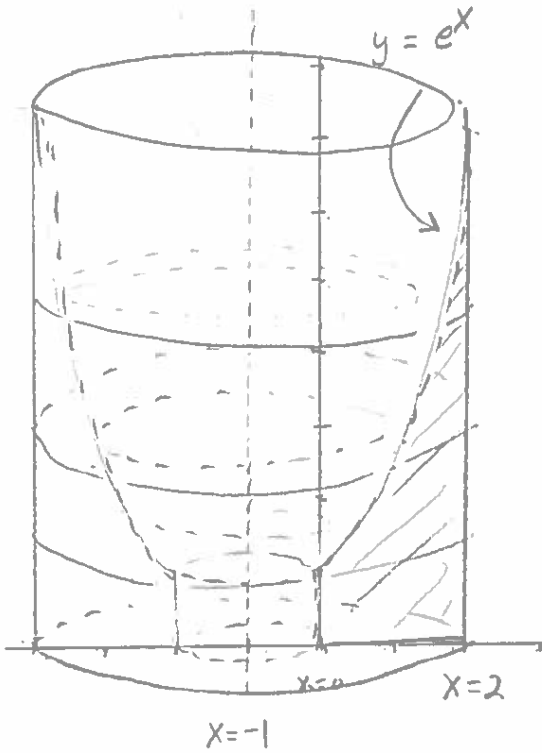


III. SET UP **AND EVALUATE** AN INTEGRAL WHICH WILL FIND THE ARC LENGTH OF THE GRAPH OF THE FUNCTION $y = \ln(\sec(x)) + 4$ ON THE INTERVAL $\pi/4 \le x \le \pi/3$.

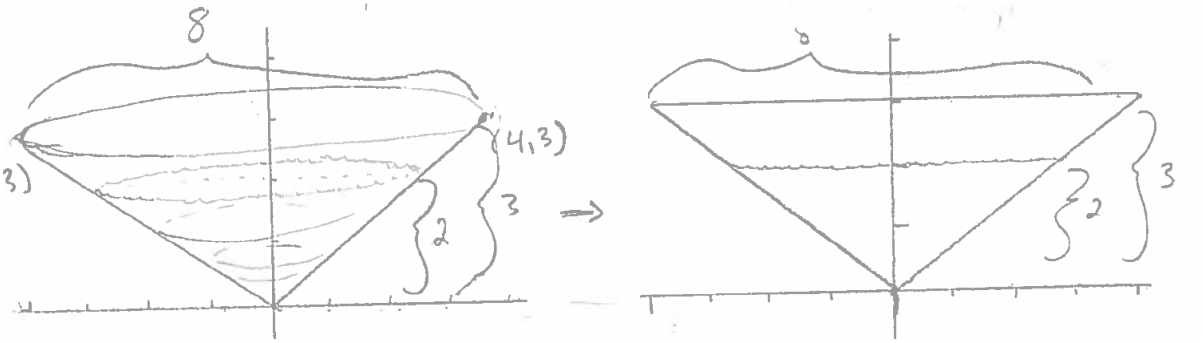
IIII. THERE ARE TWO SPRINGS. SPRING #1 REQUIRES A FORCE OF 96 NEWTONS TO STRECH 4 CENTIMETERS. SPRING #2 REQUIRES A FORCE 112 NEWTONS TO COMPRESS 7 CENTIMETERS. SHOWING ALL YOUR COMPUTATIONS, DETERMINE WHICH OF THE FOLLOWING REQUIRES MORE WORK TO BE DONE.

(A) STRETCHING SPRING #1 FROM 2 CENTIMETERS TO 4 CENTIMETERS
(B) COMPRESSING SPRING #2 FROM 3 CENTIMETERS TO 5 CENTIMETERS

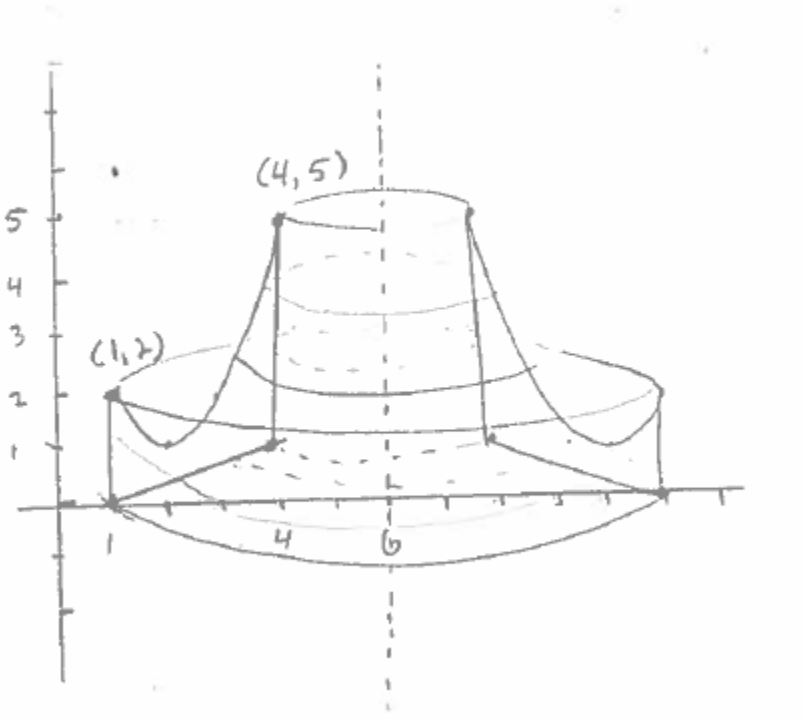
V. CONSIDER THE REGION (SEE PICTURE) BOUNDED BY THE GRAPHS OF $y = e^x$, $x = 2$, THE X-AXIS, AND THE Y-AXIS. SET UP, **USING THE SHELL METHOD**, AN INTEGRAL WHICH WILL COMPUTE THE VOLUME OF THE SOLID OF REVOLUTION FORMED BY REVOLVING THIS REGION ABOUT THE LINE $x = -1$.



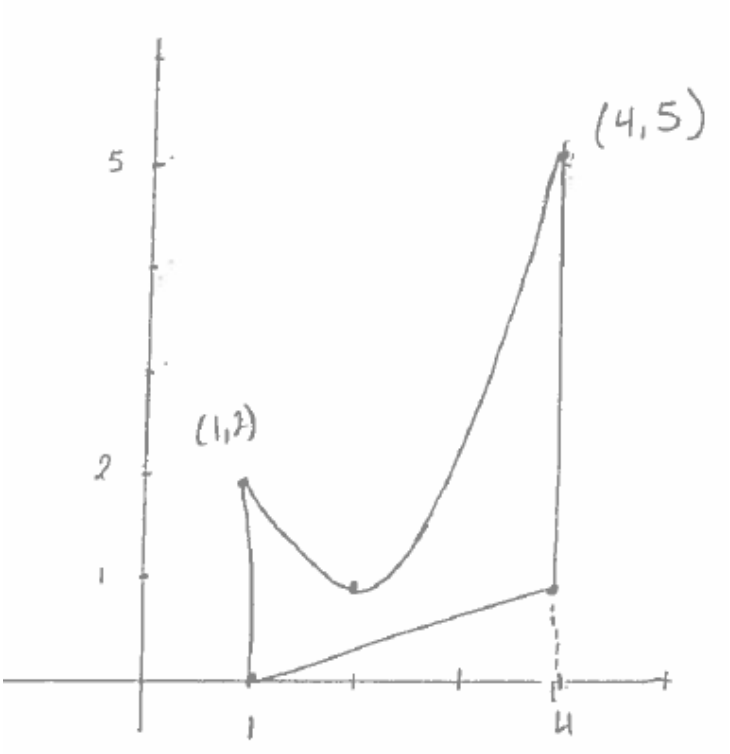
VI. A TANK CONTAINS FUEL OIL WITH DENSITY CONSTANT = δ. THE TANK IS IN THE SHAPE OF AN INVERTED CONE (SEE PICTURES) WITH HEIGHT OF 3 METERS AND BASE DIAMETER OF 8 METERS, AND IS FILLED TO A DEPTH OF 2 METERS. THE OIL IS TO BE ELEVATED AND EMPTIED OVER THE TOP EDGE OF THE TANK. SET UP AN INTEGRAL WHICH WILL FIND THE AMOUNT OF WORK DONE ACCOMPLISHING THIS TASK.



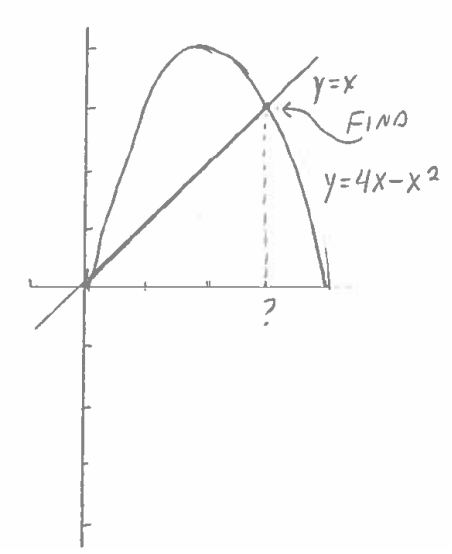
VII. CONSIDER THE REGION (SEE PICTURE) BOUNDED BY THE GRAPHS OF $y = x^2 - 4x + 5$, $y = \frac{1}{3}x - \frac{1}{3}$, $x = 1$, AND $x = 4$. SET UP AN INTEGRAL WHICH WILL COMPUTE THE VOLUME OF THE SOLID OF REVOLUTION FORMED BY REVOLVING THIS REGION ABOUT THE LINE $x = 6$.

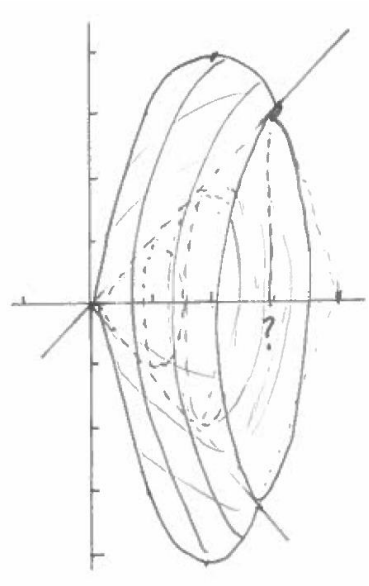


VIII. CONSIDER THE REGION ((SEE PICTURE) FROM ITEM VII, BOUNDED BY THE GRAPHS OF $y = x^2 - 4x + 5$, $y = \frac{1}{3}x - \frac{1}{3}$, $x = 1$, AND $x = 4$. SET UP THE INTEGRALS WHICH WILL DETERMINE THE CENTER OF MASS, $(\bar{x}, \bar{y})$, OF THE REGION.

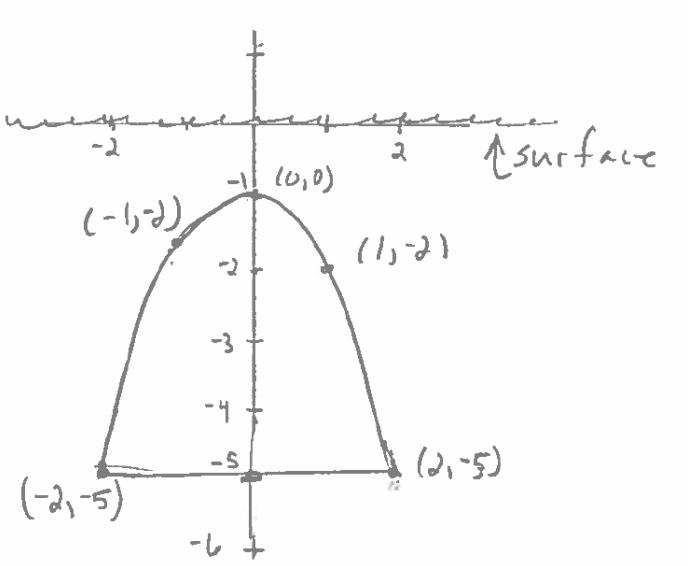


IX. CONSIDER THE REGION (SEE PICTURES) BOUNDED BY THE GRAPHS OF $y = 4x - x^2$ AND $y = x$. USING THE DISK/WASHER METHOD, SET UP AND EVALUATE AN INTEGRAL WHICH WILL COMPUTE THE VOLUME OF THE SOLID OF REVOLUTION FORMED BY REVOLVING THIS REGION ABOUT THE X-AXIS. NOTE THAT THE SOLID WILL BE "HOLLOWED OUT".





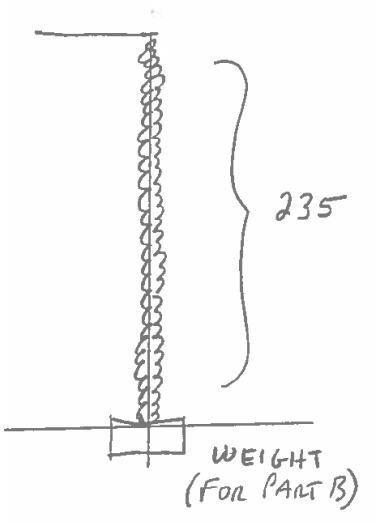
II. A PLATE IN THE SHAPE OF AN INVERTED BASIC-SHAPE PARABOLA IS SUBMERGED IN A FLUID WITH DENSITY CONSTANT = ρ SO THAT ITS BASE IS 5 UNITS BENEATH THE SURFACE (SEE PICTURE). SET UP AN INTEGRAL WHICH WILL COMPUTE THE TOTAL FLUID FORCE AGAINST ONE SIDE OF THE PLATE.



VII. A 235 METER CHAIN WEIGHING 17 KILOGRAMS PER METER IS HANGING (SEE PICTURE) FROM THE END OF A CRANE.

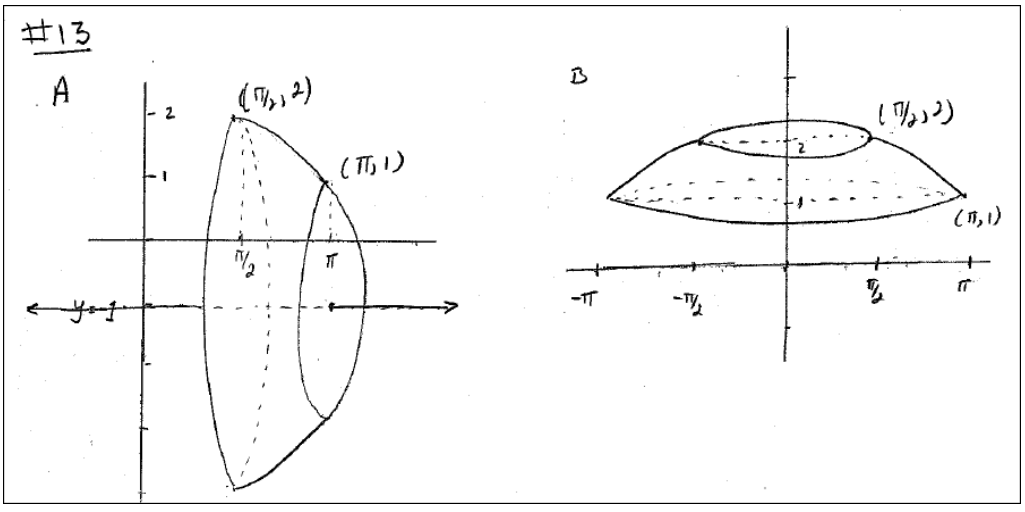
(A) SET UP **AND EVALUATE** AN INTEGRAL WHICH WILL FIND HOW MUCH WORK IS DONE PULLING UP THE ENTIRE CHAIN

(B) **COMPUTE** HOW MUCH WORK IS DONE ASSUMING A 10 KILOGRAM WEIGHT IS ATTATCHED TO THE CHAIN'S END.

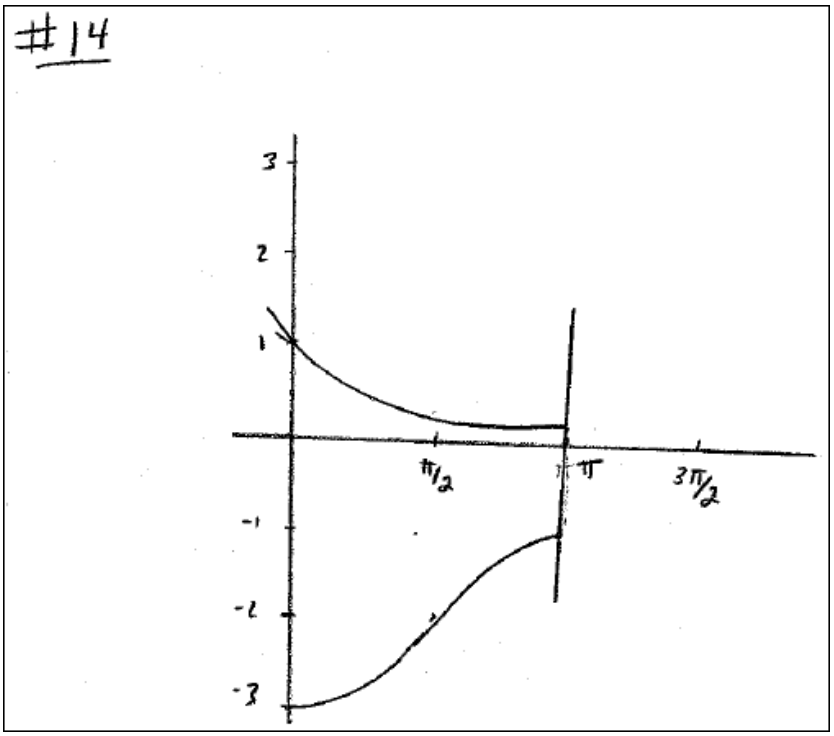


13. SET UP INTEGRALS USED TO FIND THE VOLUME OF THE SOLID GENERATED BY REVOVLVING THE CURVE $y = 1 + \sin(x))$ ON THE INTERVAL $[\pi/2, \pi]$ ABOUT:

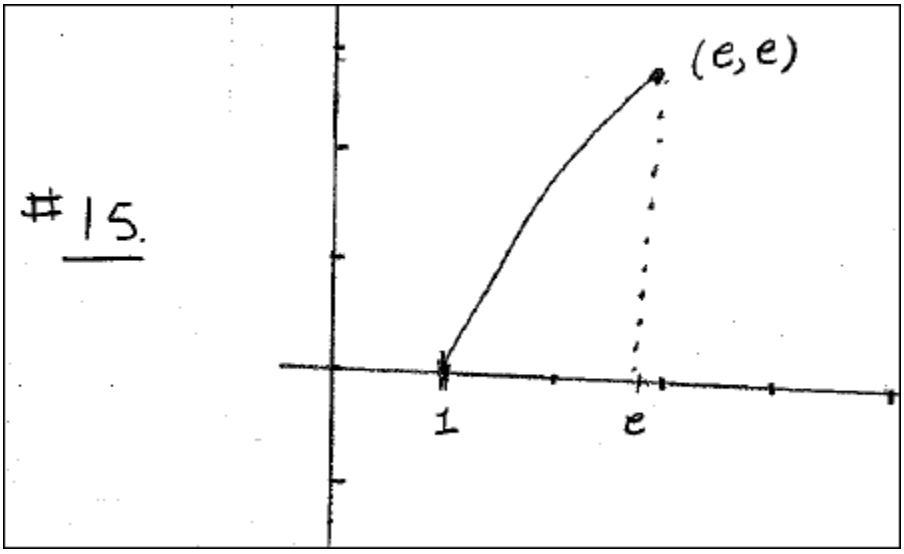
(A) THE LINE $y = -1$ (B) THE Y-AXIS



14. SET UP THE INTEGRALS USED TO FIND THE VALUES $\bar{x}$ AND $\bar{y}$ THAT DETERMINE THE CENTROID OF A LAMINA OF UNIFORM DENSITY ρ AND BOUNDED ON THE LEFT BY THE Y-AXIS, ON THE RIGHT BY THE LINE $x=\pi$, ABOVE BY THE GRAPH OF $y=e^{-x}$ AND BELOW BY THE GRAPH OF $y=-\cos(x)-2$.



15. **SET UP THE INTEGRALS** USED TO FIND THE LENGTH OF THE GRAPH $y=x\ln(x)$ ON THE INTERVAL $[1,e]$.



16. SET UP THE INTEGRALS NEEDED TO FIND THE TOTAL FLUID FORCE AGAINST ONE SIDE OF A PLATE SUBMERGED IN A FLUID WITH PRESSURE DENSITY CONSTANT OF ω , AS INDICATED IN THE FOLLOWING PICTURE.