

MTH 202 - Quiz 10

4 December 2015

Name: Solutions

Show all your work to receive full credit on the following problems; carefully organize your solutions so that the work is clear. No calculators or other electronic devices are allowed on this quiz.

1. (4 points) The minute hand of Big Ben is 14 feet long. How far does the tip of the hand travel in 15 minutes? Use an appropriate approximation of π to give your answer to the closest foot.

$$\frac{15}{60} = \frac{1}{4} \text{ revolution}$$

$$\text{Use approximation } \pi \approx \frac{22}{7}$$

$$\text{Circumference} = 2\pi \cdot 14 \text{ ft}$$

$$\therefore \text{Distance} \approx 7 \cdot \frac{22}{7} \text{ ft}$$

$$= \underline{\underline{22 \text{ ft}}}$$

$$\begin{aligned} \therefore \text{Distance traveled} &= \frac{1}{4} \cdot 2\pi \cdot 14 \text{ ft} \\ &= 7\pi \text{ ft} \end{aligned}$$

2. (10 points) A $10 \text{ m} \times 10 \text{ m}$ swimming pool is filled with water until it is 3 meters deep. A box measuring $5 \text{ m} \times 3 \text{ m} \times 2 \text{ m}$ is thrown into the pool and sinks until it is completely underwater. By how many centimeters does the depth of the water increase?

$$\text{Volume of pool} = 10 \text{ m} \times 10 \text{ m} \times 3 \text{ m} = 300 \text{ m}^3$$

$$\text{Volume of box} = 5 \text{ m} \times 3 \text{ m} \times 2 \text{ m} = 30 \text{ m}^3$$

Together, get 330 m^3 . Then

$$10 \text{ m} \times 10 \text{ m} \times (\text{new depth}) = 330 \text{ m}^3$$

$$\therefore (\text{new depth}) = 3.3 \text{ m}$$

$$\text{Change} = 0.3 \text{ m} = \underline{\underline{30 \text{ cm}}}$$

3. (4 points) Find the weight in grams of 0.000027 m^3 of water.

Recall: 1 cm^3 of water weighs 1 g .

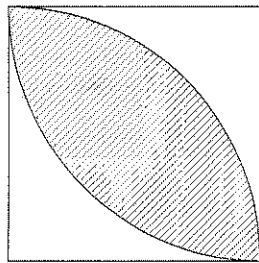
$$0.000027 \text{ m}^3 = \underbrace{0.000027}_{\text{shift decimal point 3 times}} (100 \text{ cm})^3$$

x by 100 3 times
 ↳ shift decimal point
 right $2 \times 3 = 6$ times.

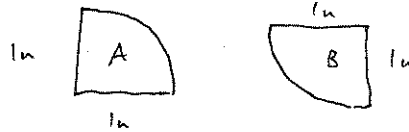
$$= 27 \text{ cm}^3$$

So 27 g.

4. (7 points) In the following diagram, two quarter circles are placed inside a square. Each side of the square is exactly 1 unit long. Find the area of the shaded region. *Hint: Write the square as the union of two regions.*



Have two quarter disks



$$A \cup B = \text{square}$$

want $\rightarrow A \cap B = \text{shaded region}$

$$\text{Area}(A \cup B) = \text{Area}(A) + \text{Area}(B) - \text{Area}(A \cap B)$$

$$1 \text{ u} \times 1 \text{ u} = \frac{1}{4} \text{ u}^2 + \frac{1}{4} \pi (1 \text{ u})^2 - \text{Area}(A \cap B)$$

$$1 \text{ u}^2 = \frac{\pi}{2} \text{ u}^2 - \text{Area}(A \cap B)$$

$$\therefore \text{Area}(A \cap B) = \underline{\underline{\left(\frac{\pi}{2} - 1\right) \text{ u}^2}} \approx 0.57 \text{ u}^2$$

(Leave in terms
of π).