

**Bergen County Math League
NO Calculators Permitted**



Contest #4

2025-2026

Answers/Solutions

4-1. **Answer:** 5
 $4n + 6 > 15$ so $n \geq 3$. 3 and 4 don't work, 5 does.

4-2. **Answer:** $-\frac{29}{16}$ or $-\frac{16}{29}$

$$\frac{13}{6} = \frac{2}{3} + \frac{3}{2}, \text{ so } \frac{4x+5}{5x+4} = \frac{4}{9} \text{ or } \frac{4x+5}{5x+4} = \frac{9}{4} \Rightarrow x = -\frac{29}{16} \text{ or } -\frac{16}{29}.$$

4-3. **Answer:** 3
 We are looking for the middle digit in the base-7 representation of 268.
 $268 = 5 \cdot 49 + 3 \cdot 7 + 2 \Rightarrow b = 3$

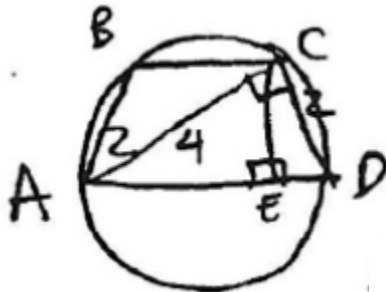
4-4. **Answer:** $\frac{\pi}{24}, \frac{5\pi}{24}$

$$\begin{aligned} 2c \cdot s^5 - 2c^5 \cdot s &= (2c \cdot s)(s^4 - c^4) \\ &= (\sin 2\theta)(s^2 + c^2)(s^2 - c^2) \\ &= -\sin 2\theta \cos 2\theta = -\frac{1}{2} \sin 4\theta = -\frac{1}{4} \Rightarrow 4\theta = \frac{\pi}{6}, \frac{5\pi}{6} \end{aligned}$$

$$\therefore \sin 4\theta = \frac{1}{2} \Rightarrow 4\theta = \frac{\pi}{6}, \frac{5\pi}{6} \Rightarrow \theta = \frac{\pi}{24}, \frac{5\pi}{24}$$

4-5. **Answer:** -3
 $\sqrt{\sqrt{\sqrt{2}}} = 2^{\frac{1}{8}} \Rightarrow \log_2 \left(\log_2 \sqrt{\sqrt{\sqrt{2}}} \right) = \log_2 \left(\frac{1}{8} \right) = -3.$

4-6. **Answer:** $\frac{6}{\sqrt{5}}$ or exact equivalent



A trapezoid inscribed in a circle is always isosceles.

$\therefore CD = 2$. Since AD is a diameter, $m\angle ACD = 90^\circ$

$$\therefore AD = \sqrt{16 + 4} = \sqrt{20} = \frac{10}{\sqrt{5}}$$

Draw E on \overline{AD} so $\overline{CE} \perp \overline{AD}$.

Area formula for $\triangle ACD$ shows:

$$\frac{1}{2}(AD)(CE) = \frac{1}{2}(AC)(CD) \Rightarrow CE = \frac{8}{\sqrt{20}} = \frac{4}{\sqrt{5}}$$

$$\therefore ED = \sqrt{(CD)^2 - (CE)^2} = \frac{2}{\sqrt{5}}, \text{ and } BC = AD - 2ED = \frac{6}{\sqrt{5}}$$

$$\therefore BC = AD - 2(ED) = \frac{6}{\sqrt{5}}$$