

MU ALPHA THETA NATIONAL CONVENTION THETA CIPHERING ANSWERS and SOLUTIONS

ANSWERS

0) 14

1) 0

2) $\frac{14}{3}\pi$

3) 5

4) 300

5) 1.44

6) $2+4\sqrt{2}$

7) 1000

8) $\frac{184}{3}$ or $61\frac{1}{3}$

9) 5

10) 39

11) 19

12) $\left(-11, -\frac{1}{2}\right) \cup (0, 11)$

SOLUTIONS

0) **30** Multiply $(5x - y)(2x + 3y)$ to get $10x^2 + 13xy - 3y^2$. So, $10 \cdot 3 = 30$.

1) **0** The determinant gives the polynomial $-4x^2 + 16x - 16$. The maximum occurs at $x = -\frac{b}{2a} = 2$. Plug back in to get $-4(2)^2 + 16(2) - 16 = 0$.

2) $\frac{14}{3}\pi$ The hour hand sweeps 140° in 4 hours and 40 minutes (30° per hour plus 20° in 40

minutes). The circumference of the clock is 12π . $\frac{140}{360} \cdot \frac{12\pi}{1} = \frac{14}{3}\pi$

$$3) \mathbf{5} \quad \frac{8x-19}{2x^2+x-15} = \frac{A(2x-5)+B(x+3)}{(x+3)(2x-5)}$$

$$8x - 9 = 2Ax - 5A + Bx + 3B$$

$$2A + B = 8$$

$$-5A + 3B = -9 \rightarrow A = 3 \text{ and } B = 2$$

$$A + B = 3 + 2 = 5$$

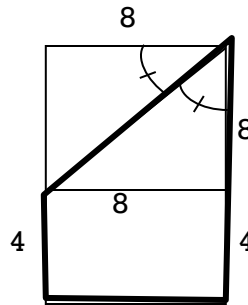
4) **2.** $(t+3)(2) = 5t$. $2t+6=5t$ and $t=2$ seconds.

5) **0.46 or 23/50.** It either rains today only which is $0.3(0.6)$ or tomorrow only which is $0.7(0.4)$. So the probability that it will rain today or tomorrow but, not both is $0.18+0.28=0.46$.

6) **$6 + 4\sqrt{2}$.** The diagonal of the square is $2 + 2\sqrt{2}$, so its side length is $2 + \sqrt{2}$ and its area is $(2 + \sqrt{2})^2 = 6 + 4\sqrt{2}$.

7) **1000** Let $y = \log(x)$. The equation simplifies to (including properties) to $y^2 - 3y - 4 = 0 \rightarrow (y - 4)(y + 1) = 0 \rightarrow y = 4$ and $y = -1$. So, $\log(x) = 4 \rightarrow 10^4 = 10,000$ and $\log(x) = -1 \rightarrow 10^{-1} = 0.1$. $10,000 \cdot 0.1 = 1000$.

8) The fold will create congruent angles as shown. The 8" edge will cover the 12" edge to create a shorter 4" edge as shown. Area of the trapezoid is $\frac{1}{2}(8)(12+4) = 4(16) = 64$



9) **0.** $x-5 = 5x^3 - 12x - 5$. $5x^3 - 13x = 0$. $x(5x^2 - 13) = 0$. $x = 0, \pm\sqrt{\frac{13}{5}}$ for a sum of 0.

10) **Day 39.** The object is for Shreeyan to get to 114 feet up, so the next day he climbs the remaining 6 feet and gets out (before sliding back). $114/3 = 38$ plus the last day gives you 39 days.

$$11) \mathbf{19} \quad 9x^2 - 18x + 25y^2 + 100y = 116$$

$$9(x^2 - 2x + 1) + 25(y^2 + 4y + 4) = 116 + 9 + 100$$

$$\frac{9(x-1)^2}{225} + \frac{(y+2)^2}{225} = \frac{225}{225}$$

$$\frac{(x-1)^2}{25} + \frac{(y+2)^2}{9} = 1$$

$$\left(\frac{x-1}{5}\right)^2 + \left(\frac{y+2}{3}\right)^2 = 1$$

Center : (1, -2) $\rightarrow x = 1, y = -2$

Major Axis = 10, Minor Axis = 6 $\rightarrow a = 10, b = 6$

Focal Radius : $c = \sqrt{25-9} = 4. \quad \frac{1}{-2}(10) + 6(4) = 19.$

12. $\left(-11, -\frac{1}{2}\right) \cup (0, 11)$. Factor the numerator and put the numbers on the number line. The denominator is always positive and does not have zeros. Now check intervals on the number line for what gives a result of less than 0. $\left(-11, -\frac{1}{2}\right) \cup (0, 11)$.