

Theta State Bowl Answers pg 1

Round 1

Part 1 $\left(\frac{\frac{1}{3} + \frac{1}{2}}{\frac{1}{9} + \frac{1}{4}}\right) 36 = \frac{12+18}{4+9} = \frac{30}{13}$

A = 30

Part 3

$\begin{array}{|c|c|} \hline k & k+8 \\ \hline + & \\ \hline 4 & 32 \\ \hline \end{array} = 8(4) \quad \underline{C = 32}$

Final: $C - A + \sqrt{B} = 32 - 30 + \sqrt{144} = 2 + 12 = \boxed{14}$

Part 2 $3x + 3x + 4x = 180$

$10x = 180$

$x = 18$

new angle $2(4x)$

B = 144

Round 2

Part 1

$\begin{array}{r} -2x - 2y = -8 \\ 5x + 2y = 11 \\ \hline 3x = 3 \\ x = 1 \end{array}$

$\begin{array}{r} 1 + y = 4 \\ y = 3 \end{array}$

A = $\frac{1+3}{2} = 2$

Part 2 $m\angle B \cong m\angle C = 65^\circ$

\overline{BD} bisects $\angle B$ so

$m\angle ABD = m\angle DBC = 32.5^\circ$

$m\angle BDC = 180 - 2(32.5) = 115$

B = 115

Final $A^C + B = 2^4 + 115 = \boxed{131}$

Part 3

$A_{sq} - A_{circle} = A_{shaded}$

side $sq = 2r$ $A_{circle} = \pi r^2$

$A_{sq} = 4r^2$ $A_{shaded} = 4r^2 - \pi r^2$

C = 4

Round 3

Part 1

$x + y = 10 \quad y = 10 - x$

$xy = 24$

x and $y = 6$ and 4

$x(10-x) = 24$

A = $\frac{1}{6} + \frac{1}{4} = \frac{5}{12}$

$10x - x^2 = 24$

$0 = x^2 - 10x + 24$

$0 = (x-6)(x-4)$

$x = 6 \quad x = 4$

Part 2

$x = .20y$

$2z = .80y \Rightarrow z = .40y$

$\frac{x}{z} = \frac{1}{2} \Rightarrow 50\%$

B = 50

Part 3

$A = \pi r^2 = 169\pi \Rightarrow r = 13$

$C = 2\pi r = 2\pi(13) = 26\pi$

C = 26

Final: $A\left(\frac{C}{B}\right) = \frac{5}{12} \left(\frac{26}{50}\right) = \boxed{\frac{13}{60}}$

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Round 4

Part 1 $y + 105 = 180$ $y = 75$
 $x + 30 = 180$ $x = 150$
 $A = x - y = 75$

Part B $x^2 - 2x - 5 = 0$
 $x = \frac{2 \pm \sqrt{4 - 4(-5)}}{2}$

$x = \frac{2 \pm 2\sqrt{6}}{2} = 1 \pm \sqrt{6}$

$B = 4(1 + \sqrt{6})(1 - \sqrt{6}) = -20$

Part 3

$x^2 + (x+7)^2 = (x+8)^2$
 $x^2 + x^2 + 14x + 49 = x^2 + 16x + 64$

$x^2 - 2x - 15 = 0$
 $(x-5)(x+3) = 0$
 $x = 5$ ~~$x = -3$~~

$C = 5$

Final

$A(B+C)$
 $75(-20+5) = \boxed{-1125}$

Round 5

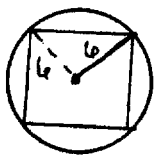
Part 1 $\frac{5}{x-5} = \frac{15}{15}$
 $x-5 = 5$
 $x = 10$

$\frac{x-2y}{x-5} = \frac{2x-4}{15} \Rightarrow \frac{10-2y}{5} = \frac{20-4}{15} \Rightarrow$

$150 - 30y = 100 - 5y$ $y = 2$

$A = \frac{10}{2} = 5$

Part 2



$S_{side}^2 = 6^2 + 6^2 = \sqrt{72}$
 $A_{sq} = S^2 = 72 \text{ sq. in.}$
 $B = 72$

Part 3

Area circle πr^2
 Area w/ increased radius = $4\pi r^2$
 50% increase 400%
 $C = 400$

Final: $\frac{C}{A} - B = \frac{400}{5} - 72 = \boxed{8}$

Round 6

Part 1 using $(1,3)$ & $(2,7) \Rightarrow m = 4$ $A = 4$
 $y - 3 = 4(x - 1) \Rightarrow y = 4x - 1$

Part 2

$\begin{bmatrix} 9 & -9 & x \\ -1 & 12 & y \end{bmatrix} = \begin{bmatrix} 6 & -6 & 4 \\ -2 & 8 & 0 \end{bmatrix} - \begin{bmatrix} 3 & 3 & 0 \\ -1 & -4 & 2 \end{bmatrix} = \begin{bmatrix} 9 & -9 & 4 \\ -1 & 12 & -2 \end{bmatrix}$ $x = 4$ $y = -2$
 $B = x + y = 2$

Part 3

$x = \frac{(-6a^3b^2)}{12ab^2} = -\frac{1a}{2} \Big|_{a=-1} = \frac{1}{2}$ $y = \frac{-12a^4b^5}{6a^2b^5} = -2a^2 = -2$

$C = \frac{y}{x} = \frac{-2}{\frac{1}{2}} = -4$

Final: $B(C-A) = +2(-4-4) = \boxed{-16}$

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Round 7

Part 1 $B - 3^{\log_3 4} = 8 - 4 = 4$ $A = 4$

Part 2 $x^2 + y^2 = 25$
 $2(xy = -8)$

$B = 3$
 $x^2 + 2xy + y^2 = 9$
 $(x+y)^2 = 9$
 $x+y = \pm 3$

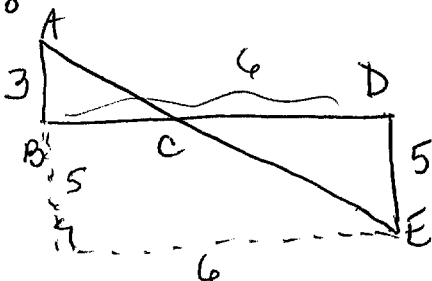
$C = 115$

Part 3
 $80 + 55 + y = 180$
 $\Rightarrow y = 45$
 $100 + 60 + x = 180$
 $\Rightarrow x = 20$
 $x + y + z = 180$
 $\Rightarrow z = 115$

Final: $\frac{C-B}{A} = \frac{115-3}{4} = \boxed{28}$

Round 8

Part 1



$(AE)^2 = 8^2 + 6^2 = \sqrt{100} = 10$

$A = 10$

Part 2

$2^{-1} = \frac{1}{2}$ $2^{-1} + 2^{-2} = \frac{1}{2} + \frac{1}{4} = \frac{3}{4}$
 $2^{-1} + 2^{-2} + \dots + 2^{-10} = \frac{1023}{1024}$

$2^{-1} + 2^{-2} + 2^{-3} = \frac{7}{8}$... See pattern

$B = 1023 - 1024 = -1$

Part 3

M's speed = $\frac{55}{60} = \frac{11}{12}$ mi/min

Sports car travels $\frac{1}{2} + \frac{1}{12}$ mile in 1 min. $\Rightarrow \frac{17}{12}$ mi/min

Convert to mph $\frac{17}{12} (60) = 85$ mph $C = 85$

Final: $A^B \cdot C = 10^{-1} (85) = \frac{1}{10} (85) = \boxed{\frac{17}{2}}$

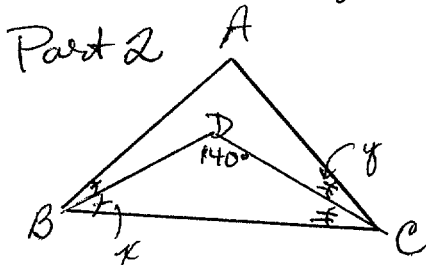
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Round 9
Part 1

$$\frac{\frac{3}{4}}{\frac{2}{3}} = \frac{1}{p} \text{ load } \quad P = \text{price of truckload}$$

A = 12.5

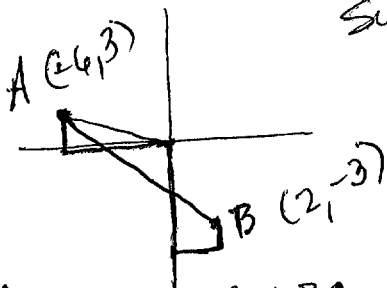
$$\frac{9}{8}P = 1 \text{ load} \Rightarrow 1.125P \text{ so } 12.5\% \text{ profit}$$



$$\begin{aligned} 2x + 2y + m \angle A &= 180 \\ 2(x+y) + m \angle A &= 180 \\ 2(40) + m \angle A &= 180 \\ m \angle A &= 100 \end{aligned}$$

$$\begin{aligned} x + y + 140 &= 180 \\ x + y &= 40 \\ \underline{B = 100} \end{aligned}$$

Part 3



Superimpose on x-y axis

$$\begin{aligned} d &= \sqrt{(-6-2)^2 + (3+3)^2} \\ &= \sqrt{64 + 36} = 10 \end{aligned}$$

C = 10

Final $6A - B + 3C = 6(12.5) - 100 + 30 = 75 - 70 = \boxed{5}$

Round 10

Part 1

A = 1

The only pair where slopes form parallel (same) values is with e (-2, 3)

Part 2

B = 40

T	10	13	16	19	22	25	28	31	34	37	40
J	0	4	8	12	16	20	24	28	32	36	40

Part 3

$$\begin{aligned} s^2 + (s+1)^2 &= (16s+1)^2 \\ s^2 + s^2 + 2s + 1 &= 16s + 1 \end{aligned}$$

$$\begin{aligned} 2s^2 - 14s &= 0 \\ 2s(s-7) &= 0 \\ s &= 7 \end{aligned}$$

C = 7

Final: $B - 2C + A$

$$40 - 2(7) + 1 = \boxed{27}$$