

## Math Team Note: Weighted Points

Individual student rankings will be determined using *weighted points*, in which more-difficult problems are accorded higher point values. This method will *not* affect individual scores leading to team totals that determine team standings in the division, section, or state. Individual student rankings are used to determine the awards for the top 10 students in the division (including identifying the top student who then automatically qualifies for the State Tournament Invitational Event) as well as the top 75 or so students statewide, who then also qualify for the State Tournament Individual Event. This note defines weighted points.

The number of weighted points  $P_{wtd}$  is defined as

$$P_{wtd} = P_{nom} + \ln\left(\frac{1+N}{1+n}\right)$$

where  $P_{nom}$  = nominal points for the problem

$N$  = number of scoring-team students participating in the event

$n$  = number of scoring-team students who answer the problem correctly

### Additional Notes

- The nominal points are  $P_{nom} = 1$  point for Problem #1,  $P_{nom} = 2$  points for Problems #2-4. These represent the minimum weighted points (when each scoring-team student answers correctly).
- If a problem allows partial credit (e.g., 1 out of 2 points), then each scoring student who scores a proportion of the maximum number of points would contribute that same proportion toward the determination of  $n$ . Students then scoring 1 of 2 nominal points would receive half of the weighted points.
- For the sample case of an eight-team division,  $N = (4 \text{ students/team})(8 \text{ teams}) = 32$  students, the maximum weighted points (when no scoring-team student answers correctly) for Problem #1 is approximately 4.50 points and for Problems #2-4 is approximately 5.50 points.
- For the state, with  $N \cong (4 \text{ students/team})(178 \text{ teams}) = 712$  students, the maximum effective points for Problem #1 is approximately 7.57 points and for Problems #2-4 is approximately 8.57 points.
- A graph of  $P_{wtd}$  versus  $n$  (with  $N = 32$ ) is shown. The data labels indicate  $P_{wtd}$  rounded to the nearest 0.01.

