2005 Thunder Bay High School Mathematics Competition

Junior Individual Answers

For complete solutions to any of the problems or for discussions of any of the problems, email ryanholm72@hotmail.com.

Note to markers: For the full solution questions students are expected to provide much more detail than I have here to receive full marks; this is just a reference sheet.

Note to students: The solutions provided here are only *sketch solutions*. Steps have been omitted and the solutions are meant to guide any student who has made a valiant attempt at solving the problem.

Multiple Choice:

1. C	9. A
2. C	10. A
3. A	11. A
4. E	12. A
5. B	13. B
6. E	14. C
7. C	15. C
8. E	

Full Solution (Answers and sketch solutions):

1. (a) 5. Two distinct lines intersect in exactly one point. A line and a circle can intersect in at most 2 two points. So there are at most 5 points of intersection and a simple picture shows that such a 5-point intersection can be achieved.
   (b) 0. Two distinct parallel lines intersect in 0 points. A line and a circle can intersect in 0 places. So there are at least 0 points of intersection and a simple picture shows that such a 0 point intersection can be achieved.

2. 14. Line up the numbers and subtract them like you learned to do in elementary school. Notice that $X > 4$ since the answer of the subtraction begins with 16 and not 17. Also notice that you must "carry over" in order to subtract the units' digits. So $14 - X = Y$ and adding X to each side of this equation gives $X + Y = 14$.

3. 9.5 hours. Let h be the numbers of hours it takes him. Then with the given information, we have that

   $$1 + \frac{750}{19} \text{ x } \frac{1}{100}h = 50 \text{ x } \frac{1}{100} h.$$ Solving gives $h = 9.5$.

4. $A > D > B > C$, where A, B, C, D are the scores of Ann, Bill, Carol, and Dick, respectively. We have that:
   (I) $A + C = B + D$
   (II) $A + B > C + D$
   (III) $D > B + C$
   Adding (I) and (II) gives that $A > D$. (III) shows that $D > B$ since the scores are non-negative. Subtracting (I) from (II) gives that $B > C$. So combining these three inequalities gives $A > D > B > C$.

5. 200. The parallel lines divide the original triangle up into nine other triangles that are similar to the original triangle. Let b and h be the base and height, respectively, of the original triangle. The largest part of the division is a trapezoid with height $\frac{1}{10}h$ and bases of length b and $\frac{9}{10}b$. Since the area of this trapezoid is 38 then we have that $\frac{1}{2}\times\frac{1}{10}h\times(b+\frac{9}{10}b)=38$, so upon simplifying this expression, $\frac{1}{2}b\times h=200$.