Intermediate Math Circles
Analytic Geometry I

Problems

1. Three points are *collinear* if they all lie on a straight line. Show that $P(-12, 1)$, $Q(-4, -3)$ and $R(6, -8)$ are collinear.
   (a) Use a slope argument to show collinearity.
   (b) Use a distance argument to show collinearity.
2. The point $A(-2, y)$ is on a line that passes through the points $T(0, -2)$ and $W(4, 0)$. Determine the value of y.
3. $\triangle ABC$ has vertex A on the x-axis at -2 and vertex C on the x-axis at 8. The third vertex B is on the y-axis at b such that $\angle ABC = 90°$. Determine all possible values of b.
4. A point W is located on the x-axis so that it is 13 units from the point $R(7, 5)$. Find the coordinates of point W.
5. The points A and B are located in the first quadrant, equidistant from the origin, O. If the slope of OA is 7 and the slope of OB is 1, determine the slope of AB.
6. The vertices of $\triangle ABC$ are $A(-2, -11)$, $B(10, 5)$ and $C(12, 3)$.
   (a) Determine the midpoint M of line segment AB.
   (b) Show that $AM = MB = MC$. This will prove that M is the centre of a circle containing points A, B and C on the circumference.
   (c) Show that $\angle ACB = 90°$.
7. The line segment AB, where A is $(2, -4)$ and B is $(10, 8)$, is divided at Q in the ratio $3 : 5$. Find the coordinates of Q.