

22. Prove analytically that the sum of the squares of the medians of a triangle is equal to three-fourths the sum of the squares of the sides.
23. Prove analytically that the line segments joining the midpoints of opposite sides of a quadrilateral bisect each other.
24. Prove that the coordinates (x, y) of the point Q that divides the line segments from $P_1(x_1, y_1)$ to $P_2(x_2, y_2)$ in the ratio $r_1:r_2$ are determined by the formulas

$$x = \frac{r_1x_2 + r_2x_1}{r_1 + r_2} \quad \text{and} \quad y = \frac{r_1y_2 + r_2y_1}{r_1 + r_2}$$

(Hint: Use the reasoning of Problem 5.)

25. Find the coordinates of the point Q on the segment P_1P_2 such that $\overline{P_1Q}/\overline{QP_2} = \frac{2}{7}$, if (a) $P_1 = (0, 0)$, $P_2 = (7, 9)$; (b) $P_1 = (-1, 0)$, $P_2 = (0, 7)$; (c) $P_1 = (-7, -2)$, $P_2 = (2, 7)$; (d) $P_1 = (1, 3)$, $P_2 = (4, 2)$.

Ans. (a) $(\frac{14}{9}, 2)$; (b) $(-\frac{7}{9}, \frac{14}{9})$; (c) $(-5, \frac{28}{9})$; (d) $(\frac{13}{9}, \frac{32}{9})$

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