

## STEP II, 2003, Q4

- 4 The line  $y = d$ , where  $d > 0$ , intersects the circle  $x^2 + y^2 = R^2$  at  $G$  and  $H$ . Show that the area of the minor segment  $GH$  is equal to

$$R^2 \arccos\left(\frac{d}{R}\right) - d\sqrt{R^2 - d^2}. \quad (*)$$

In the following cases, the given line intersects the given circle. Determine how, in each case, the expression (\*) should be modified to give the area of the minor segment.

- (i) Line:  $y = c$ ; circle:  $(x - a)^2 + (y - b)^2 = R^2$ .
- (ii) Line:  $y = mx + c$ ; circle:  $x^2 + y^2 = R^2$ .
- (iii) Line:  $y = mx + c$ ; circle:  $(x - a)^2 + (y - b)^2 = R^2$ .



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