1. Including a *sketch*, describe the *parallel-axis theorem* for area moments of inertia. ②
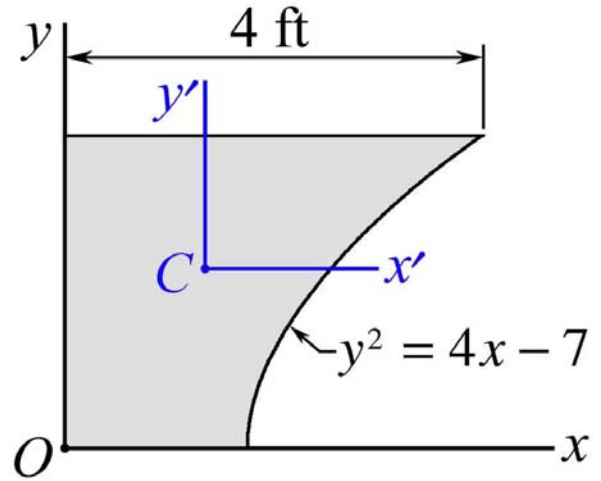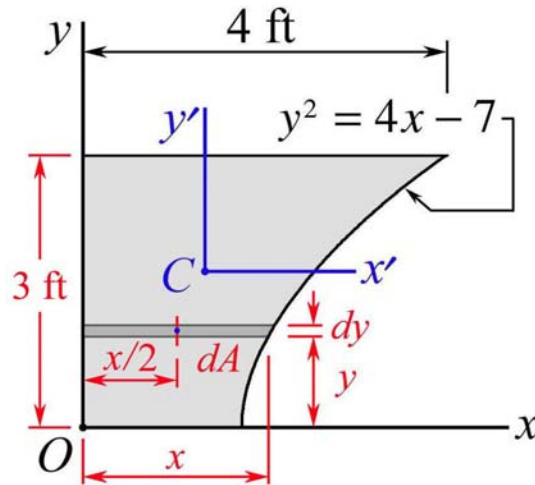
2. A shaded area is shown, where $C(\overline{x}, \overline{y})$ is its centroid. For this shaded area, determine *(a)* its total area A, *(b)* the value of $\overline{x}$, *(c)* the moment of inertia I_x, *(d)* the radius of gyration k_x. ⑧

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1. PAT and sketch   ②

2.

$$x = \tfrac{1}{4}(7 + y^2) \qquad \overline{x}_{el} = \tfrac{x}{2} = \tfrac{1}{8}(7 + y^2) \qquad dA = x\,dy = \tfrac{1}{4}(7 + y^2)\,dy$$

POM$_1$: $A = \int dA = \int_0^3 \tfrac{1}{4}(7 + y^2)\,dy = 7.5$ $\boxed{A = 7.5 \text{ ft}^2}$ ②

POM$_2$: $\overline{x}A = \int \overline{x}_{el}\, dA = \tfrac{1}{32}\int_0^3 (7 + y^2)^2\,dy = 10.05$ $\boxed{\overline{x} = 1.34 \text{ ft}}$ ②

$I_x = \int y^2 dA = \int y^2 \cdot x\,dy = \int_0^3 \tfrac{1}{4}(7y^2 + y^4)\,dy = 27.9$ $\boxed{I_x = 27.9 \text{ ft}^4}$ ②

$I_x = k_x^2 A$: $27.9 = k_x^2(7.5)$ $k_x = 1.9287$ $\boxed{k_x = 1.929 \text{ ft}}$ ②