Problem A. Length of a plane curve.

(2) 10.5  (3) 6a  (4) 12
(5) \(\frac{8}{27}(10\sqrt{10} - 1)\)  (6) \(\frac{14}{3}\)
(7) \(\frac{53}{6}\)  (8) \(\frac{123}{32}\)  (9) \(\frac{4}{27}(10\sqrt{10} - 1)\)
(10) \(\frac{a\pi^2}{8}\)  (11) 8  (12) 12  (13) \(\frac{21}{2}\)
(14) \(\frac{27}{20}\)  (15) \(\frac{19}{3}\)  (16) \(f(x) = a \pm x\sqrt{A^2 - 1}, \ |A| \geq 1\)
(17) No

Problem B. Surface area.

(2) \(4\pi^2r^2\)  (3) \(99\pi/2\)  (4) \(\frac{\pi}{27}(10\sqrt{10} - 1)\)
(5) \(\frac{\pi}{6}(17\sqrt{17} - 1)\)  (6) \(1823\pi/18\)  (7) \(253\pi/20\)
(8) \(\frac{2\pi}{3}(2\sqrt{2} - 1)\)  (9) \(12\pi a^2/5\)  (10) \(\frac{2\pi}{3}(26\sqrt{26} - 2\sqrt{2})\)
(11) \(56\pi\sqrt{3}/5\)  (12) \(424\pi/15\)  (13) \(153\pi/40\)

Problem C. Center of mass.

(1) At the intersection of the lines through each vertex which are perpendicular to the opposite side.

(2) At \((0, (2/\pi)r, 0)\) if the center is at \((0, 0)\) and the \(y\)-axis cuts the semicircle in half.

(3) At \((0, (8/15)r, 0)\) if the hemisphere is sitting on the \(x-z\) plane with its apex at \((0, r, 0)\).

(4) \((4a/3\pi, 4a/3\pi)\)  (5) \((0, (2/5)h^2)\)  (6) \((2a/3(4 - \pi), 2a/3(4 - \pi))\)
(7) $(\pi/2, \pi/8)$  (8) $(2/5, 1)$  (9) $(3/7)h$  (10) $(3/5)h$

(11) On the axis of the cone $3h/4$ from the vertex.

(12) On the axis of the cone $3h/5$ from the vertex.

(13) At $(0, \pi r/4)$ if the semicircle is positioned as in (2).

(14) At $(0, (3/8)r, 0)$ if the hemisphere is positioned as in (3).

(15) At $(0, (1/2)r, 0)$ if the hemisphere is positioned as in (3).

(16) $(0, 2c^2/5)$  (17) $(16/105, 8/15)$  (18) $(0, 12/5)$

(19) $(1, -3/5)$  (20) $(3/5, 1)$

(21) On the axis of the cone $3h/4$ from the vertex.

(22) $(0, 8/3)$  (23) $(4/5, 0)$

(24) On the axis of the cone $2h/3$ from the vertex.

(25) $(-r, 3r/(2 + \pi))$  (26) $(17\sqrt{17} - 1)/12$

(27) $(2r/\pi, 2r/\pi)$

Problem B. Average value of a function.

(2) $50\frac{1}{2}$  (3) 126  (4) 117

(5) 21536939630755577663107.46  (10) $2/\pi$  (11) 0

(12) $1/2$  (13) $1/2$  (14) $49/12$  (15) $1/2$

(16) $\alpha \left(\frac{a + b}{2}\right) + \beta$  (17a) 200 cases  (17b) 1 dollar per day

(18) $\frac{a}{3}(3\sqrt{3} - 1)$  (19a) $\frac{2}{3}b^2$  (19b) $\frac{2}{3}b$

(20a) 72  (20b) $82\frac{2}{3}$  (21) $50 + 28/\pi$