22. $y = x^2$ and $y = 4$; about the line $y = 4$.

(A) $\frac{256\pi}{15}$ **(B)** $\frac{256\pi}{5}$ **(C)** $\frac{512\pi}{5}$ **(D)** $\frac{512\pi}{15}$ **(E)** $\frac{64\pi}{3}$

23. An arch of $y = \sin x$ and the x-axis; about the x-axis.

(A) $\frac{\pi}{2}\left(\pi - \frac{1}{2}\right)$ **(B)** $\frac{\pi^2}{2}$ **(C)** $\frac{\pi^2}{4}$ **(D)** π^2 **(E)** $\pi(\pi - 1)$

24. A trapezoid with vertices at (2, 0), (2, 2), (4, 0), and (4, 4); about the x-axis.

(A) $\frac{56\pi}{3}$ **(B)** $\frac{128\pi}{3}$ **(C)** $\frac{92\pi}{3}$

(D) $\frac{112\pi}{3}$ **(E)** none of these

25. The base of a solid is a circle of radius a, and every plane section perpendicular to a diameter is a square. The solid has volume

(A) $\frac{8}{3}a^3$ **(B)** $2\pi a^3$ **(C)** $4\pi a^3$ **(D)** $\frac{16}{3}a^3$ **(E)** $\frac{8\pi}{3}a^3$

26. The base of a solid is the region bounded by the parabola $x^2 = 8y$ and the line $y = 4$, and each plane section perpendicular to the y-axis is an equilateral triangle. The volume of the solid is

(A) $\frac{64\sqrt{3}}{3}$ **(B)** $64\sqrt{3}$ **(C)** $32\sqrt{3}$

(D) 32 **(E)** none of these

27. The base of a solid is the region bounded by $y = e^{-x}$, the x-axis, the y-axis, and the line $x = 1$. Each cross section perpendicular to the x-axis is a square. The volume of the solid is

(A) $\frac{e^2}{2}$ **(B)** $e^2 - 1$ **(C)** $1 - \frac{1}{e^2}$

(D) $\frac{e^2 - 1}{2}$ **(E)** $\frac{1}{2}\left(1 - \frac{1}{e^2}\right)$

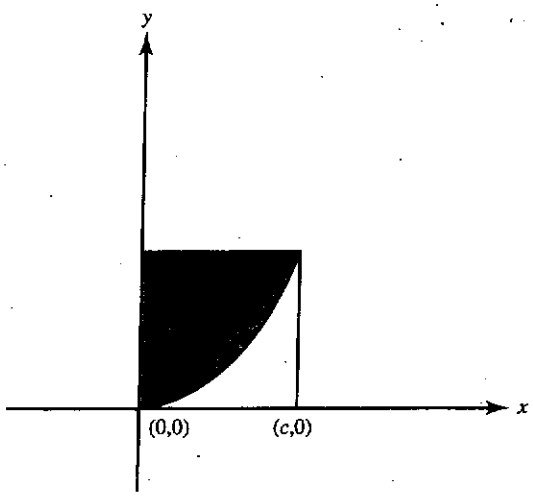
ARC LENGTH

28. The length of the arc of the curve $y^2 = x^3$ cut off by the line $x = 4$ is

(A) $\frac{4}{3}(10\sqrt{10} - 1)$ **(B)** $\frac{8}{27}(10^{3/2} - 1)$ **(C)** $\frac{16}{27}(10^{3/2} - 1)$

(D) $\frac{16}{27}10\sqrt{10}$ **(E)** none of these

17. The figure below shows part of the curve of $y = x^3$ and a rectangle with two vertices at $(0, 0)$ and $(c, 0)$. What is the ratio of the area of the rectangle to the shaded part of it above the cubic?



(A) 3:4 **(B)** 5:4 **(C)** 4:3 **(D)** 3:1 **(E)** 2:1

VOLUME

In Questions 18–24 the region whose boundaries are given is rotated about the line indicated. Choose the alternative that gives the volume of the solid generated.

18. $y = x^2$, $x = 2$, and $y = 0$; about the x-axis.

(A) $\frac{64\pi}{3}$ **(B)** 8π **(C)** $\frac{8\pi}{3}$ **(D)** $\frac{128\pi}{5}$ **(E)** $\frac{32\pi}{5}$

19. $y = x^2$, $x = 2$, and $y = 0$; about the y-axis.

(A) $\frac{16\pi}{3}$ **(B)** 4π **(C)** $\frac{32\pi}{5}$ **(D)** 8π **(E)** $\frac{8\pi}{3}$

20. The first quadrant region bounded by $y = x^2$, the y-axis, and $y = 4$; about the y-axis.

(A) 8π **(B)** 4π **(C)** $\frac{64\pi}{3}$ **(D)** $\frac{32\pi}{3}$ **(E)** $\frac{16\pi}{3}$

21. $y = x^2$ and $y = 4$; about the x-axis.

(A) $\frac{64\pi}{5}$ **(B)** $\frac{512\pi}{15}$ **(C)** $\frac{256\pi}{5}$

(D) $\frac{128\pi}{5}$ **(E)** none of these

22. $y = x^2$ and $y = 4$; about the line $y = 4$.

(A) $\frac{256\pi}{15}$ **(B)** $\frac{256\pi}{5}$ **(C)** $\frac{512\pi}{5}$ **(D)** $\frac{512\pi}{15}$ **(E)** $\frac{64\pi}{3}$

23. An arch of $y = \sin x$ and the x-axis; about the x-axis.

(A) $\frac{\pi}{2}\left(\pi - \frac{1}{2}\right)$ **(B)** $\frac{\pi^2}{2}$ **(C)** $\frac{\pi^2}{4}$ **(D)** π^2 **(E)** $\pi(\pi - 1)$

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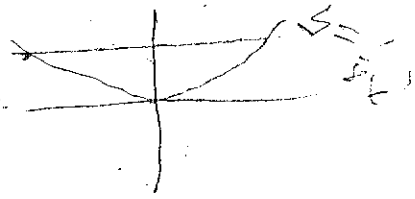

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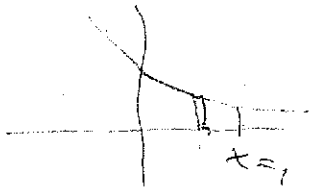

ARC LENGTH

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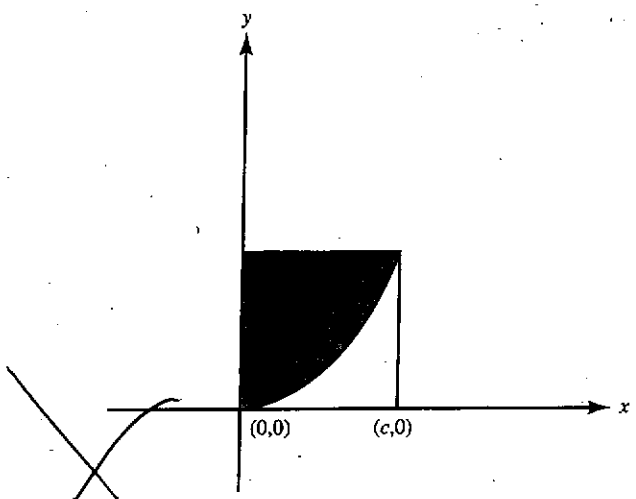

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VOLUME

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19. $y = x^2$, $x = 2$, and $y = 0$; about the y-axis.

(A) $\frac{16\pi}{3}$ **(B)** 4π **(C)** $\frac{32\pi}{5}$ **(D)** 8π **(E)** $\frac{8\pi}{3}$

20. The first quadrant region bounded by $y = x^2$, the y-axis, and $y = 4$; about the y-axis.

(A) 8π **(B)** 4π **(C)** $\frac{64\pi}{3}$ **(D)** $\frac{32\pi}{3}$ **(E)** $\frac{16\pi}{3}$

21. $y = x^2$ and $y = 4$; about the x-axis.

(A) $\frac{64\pi}{5}$ **(B)** $\frac{512\pi}{15}$ **(C)** $\frac{256\pi}{5}$

(D) $\frac{128\pi}{5}$ **(E)** none of these