1. Find the area of the region in the first quadrant enclosed by the graphs of $y = \cos x$, $y = x$ and the y – axis.

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2. Find the volume of the solid formed by revolving the region bounded by the graphs of $y = 4x - x^2$ and $y = 0$ about the x – axis.

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3. A solid is generated when the region in the first quadrant enclosed by the graph of $y = (x^2 + 1)^3$, the line $x = 1$, the x – axis, and the y – axis is revolved about the x – axis. Its volume is found by evaluating which of the following integrals?

A. $\pi \displaystyle\int_1^8 \left(x^2 + 1\right)^3 dx$

B. $\pi \displaystyle\int_1^8 \left(x^2 + 1\right)^6 dx$

C. $\pi \displaystyle\int_0^1 \left(x^2 + 1\right)^3 dx$

D. $\pi \displaystyle\int_0^1 \left(x^2 + 1\right)^6 dx$

E. $2\pi \displaystyle\int_0^1 \left(x^2 + 1\right)^6 dx$

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4. The region bounded by the graph of $y = 2x - x^2$ and the x – axis is the base of a solid. For this solid, each cross section perpendicular to the x – axis is an equilateral triangle. What is the volume of this solid?

5. The base of a loud speaker is determined by the two curves $y = \dfrac{x^2}{10}$ and

$y = -\dfrac{x^2}{10}$ for $1 \le x \le 4$ as shown in the figures to the right. For this loud speaker, the cross sections perpendicular to the x – axis are squares. What is the volume of this speaker, in cubic units?
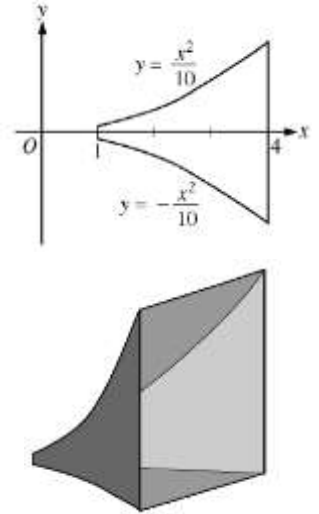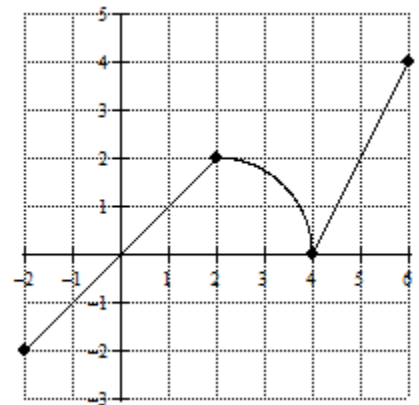
6. The slope field pictured below represents all general solutions to which of the following differential equations?

A. $\dfrac{dy}{dx} = 2x$

B. $\dfrac{dy}{dx} = -2x$

C. $\dfrac{dy}{dx} = -y$

D. $\dfrac{dy}{dx} = y$

E. $\dfrac{dy}{dx} = x + y$
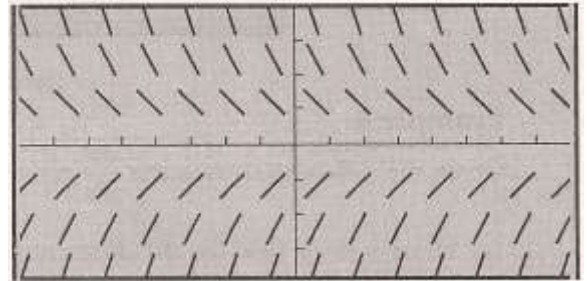
7. The graph of a function f, which consists of two line segments and a quarter circle, is pictured to the right. If $H(x) = \displaystyle\int_{-2}^{x} f(t)dt$, which of the following statements is true?

A. $H(4) < H'(2) < H''(3)$

B. $H(4) < H''(3) < H'(2)$

C. $H'(2) < H(4) < H''(3)$

D. $H''(3) < H(4) < H'(2)$

E. $H''(3) < H'(2) < H(4)$

8. Using the substitution $u = \sqrt{x}$, $\int_1^9 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$ is equal to which of the following?

    A. $2\int_1^{81} e^u\, du$ B. $2\int_1^9 e^u\, du$

    C. $2\int_1^3 e^u\, du$ D. $\frac{1}{2}\int_1^3 e^u\, du$

    E. $\int_1^9 e^u\, du$

9. $\displaystyle\int_0^1 e^{-3x}\, dx =$

10. If $\displaystyle g(x) = \int_1^{2x} \frac{3t}{t^3+1}\, dt$, then what is the value of $g'(2)$?

11. $\displaystyle\int \frac{2x^2}{x^3-2}\, dx =$

Free Response #1 – Calculator NOT Permitted

Consider the differential equation $\dfrac{dy}{dx} = -\dfrac{2x}{y}$.

a. On the axes provided, sketch a slope field for the given differential equation at the twelve points indicated.

b. Write an equation of the tangent line to the graph of f at $(1, -1)$ and use it to approximate $f(1.1)$.

c. Find the particular solution $y = f(x)$ to the given differential equation with the initial condition $f(1) = -1$.
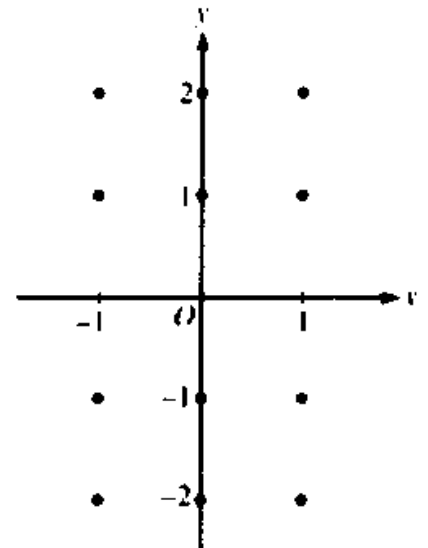
Free Response #2 – Calculator Permitted
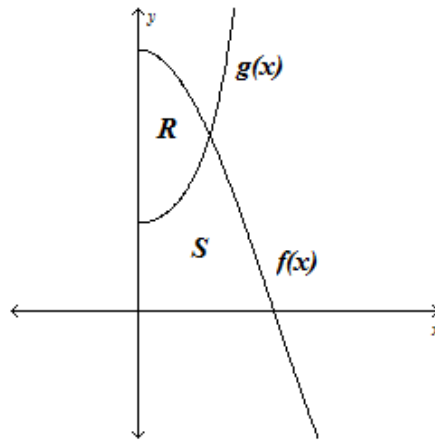
Let R be the region in the first quadrant bounded by the y – axis and the graphs of $f(x) = 3\cos x$ and $g(x) = e^{x^2}$. Let S be the region in the first quadrant bounded by the graphs of $f(x)$, $g(x)$ and the x – axis.

a. Find the area of region S.

b. Region R is rotation about the line $y = 4$. Find the volume of the solid generated.

c. Region R is the base of a solid whose cross sections are equilateral triangles. Find the volume of this solid.