Show all your work.
Reasonable supporting work must be shown to earn credit.

1. [4] (ActivityTrigSub \#1) One problem required a substitution of $x=3 \sin (\theta)$. Find the following in terms of $x$.
(a) $\csc (\theta)$
(b) $\cos (\theta)$
2. Each of the following is wrong. Explain why.
(a) $[2]\left(\right.$ Quiz5\#1) $\int u d v=u v-v d u$
(b) $[2]$ (WebHW7-3\#1) $\int_{1}^{2} \frac{4}{\sqrt{4+x^{2}}} d x=\int_{1}^{2} \frac{8 \sec ^{2}(\theta)}{\sqrt{4+(2 \tan (\theta))^{2}}} d \theta$ where $x=2 \tan (\theta)$.
(c) [2] (WrittenHW7-2\#4) $\int_{0}^{\frac{\pi}{4}} \sin ^{5}(x) d x=\int_{0}^{\frac{\sqrt{2}}{2}} u^{5} d u$ where $u=\sin (x)$.
(d) [2] (ActivityVolume) The region bounded by $y=\frac{1}{2} x^{3}, y=4$, and $x=0$ when revolved around the $y$-axis has volume equal to $\int_{0}^{2} \pi(\sqrt[3]{2 y})^{2} d y$
3. A particle is moving along a straight line with velocity $v(t)=\sin \left(\frac{x}{\pi}\right) \cos \left(\frac{x}{\pi}\right)$ measured in meters per second.
(a) [4] (WebHW7-2\#9) Find the position function of the particle if we know at time 0 , the position is 0 .
(b) [3] (WordProblem2\#1) Find the instantaneous acceleration of the particle after one minute.
4. Let $g$ be the line graphed below on the right. Let $f$ be a function that is continuous and twice differentiable to continuous functions. Assume that we also have the following values for $f$ and $f^{\prime}$.

| $x$ | $f(x)$ | $f^{\prime}(x)$ |
| :---: | :---: | :---: |
| 0 | 2 | 3 |
| 4 | 7 | 5 |

(a) [1] Find $f(4)$.
(b) [2] Find $g^{\prime}(4)$.

(c) $[3]\left(\right.$ practiceExam2 \#4) Evaluate $\int_{0}^{4} f^{\prime}(x) d x$
(d) [4] (practiceExam2 \#4) Evaluate $\int_{0}^{4} g(x) f^{\prime}(x) d x$
5. For each of the following, identify the technique you would use to find the indefinite integral. For example, if you think substitution would work, write "substitution" and identify what $u$ would be. If you think integration by parts, write "integration by parts" and identify what $u$ and $d v$ would be.
(a) $[2]$

$$
\int \cos ^{5}(t) d t
$$

(b) $[2]$

$$
\int y \sqrt{y-4} d y
$$

(c) $[2]$

$$
\int x \sin (x) d x
$$

6. [4] Evaluate one of the indefinite integrals above.
7. (WebHW7-2) Consider the curves $f(x)=\cos ^{2}(x), g(x)=\cos ^{3}(x)$ graphed below.
(a) [2] Identify which graph is $f$ and which is $g$. Justify your answer.

(b) [2] Set up the definite integral that would evaluate the area bounded by $f, g$, and the vertical lines $x=0$ and $x=2 \pi$. Do not compute this!!
8. (SuggestedWrittenHW6-2\#69) Define an object, $S$, with a triangular base in the $x y$ plane with vertices $(0,0),(2,0)$, and $(0,1)$. The cross-sections of $S$ perpendicular to the $y$-axis form squares.
(a) [2] Sketch the base of the object $S$ on the $x y$ plane to the right.
(b) [2] Recall that the volume can be calculated by taking limits of approximating slices/sections/cylinders/shapes. Draw such an approximating slice/section/cylinder/shape that you can use to find the volume of $S$. Be sure to include the $x, y$, and $z$ axis.

(c) [3] Set up the definite integral that would find the volume of $S$. Do not compute this!!
