The list below contains integration problems using the techniques of substitution, integration by parts, method of partial fractions, and trig substitution.

a) Identify and record the technique you think will work the best.
b) Give the “set-up” for your technique.
c) Write out the integral in the form where it is ready to be integrated.

1. Evaluate $\int \sin^2 \theta \, d\theta$ using integration by parts.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Set-Up</th>
<th>Integral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Evaluate $\int \frac{x^2}{\sqrt{9-x^2}} \, dx$

3. Evaluate $\int \arctan(x) \, dx$

4. Evaluate $\int \frac{x^2}{(4-x^2)^{3/2}} \, dx$

5. Evaluate $\int \frac{1+x^2}{x(1+x)^2} \, dx$

6. Evaluate $\int e^{2\theta} \sin(3\theta) \, d\theta$.

7. Evaluate $\int \frac{dx}{x^2 \sqrt{x^2 + 4}}$

8. Evaluate $\int y \sqrt{y+3} \, dy$

9. Evaluate $\int \frac{dx}{x^2 + 16}$

10. Evaluate $\int \frac{2s^2 + s + 23}{(s+4)(s^2+1)} \, ds$
HINTS

1. letting \( u = \sin \theta \) and \( v' = \sin \theta \). Then use the identity \( \sin^2 \theta + \cos^2 \theta = 1 \) to replace \( \cos^2 \theta \). From there, you should be able to finish the problem and find the antiderivative requested.

2. using the trig substitution \( x = 3\sin \theta \). You will need the result from \#1 above to finish this. Show the triangle that fits this problem. Write your final answer in terms of \( x \).

3. using the trig substitution \( x = 2 \tan \theta \). Show the triangle that fits this problem. Write your final answer in terms of \( x \).

4. using trig substitution. You may need to use the identity \( \sin^2 \theta + \cos^2 \theta = 1 \) to replace \( \sin^2 \theta \) in your integrand.

5. using trig substitution.

6. You will need to do integration by parts twice.

7. using integration by parts.

8. first using the substitution \( w = y + 3 \). Then try this one using integration by parts, letting \( u = y \).

9. using the method of partial fractions.

10. using the method of partial fractions.

11. You can also work problem number 1 above by rewriting the integrand using the trig identity \( \sin^2 \theta = \frac{1 - \cos(2\theta)}{2} = \frac{1}{2}(1 - \cos(2\theta)) \) and evaluate without using integration by parts. Try this on your own if you like.