# SECTION 4.10 ANTIDERIVATIVES

- (families of) antiderivatives
- definite integrals
- initial value problems

1. Find the (family of) antiderivatives for the following.

   (a) $f(x) = x^3$ (b) $f(x) = 5\sin(x)$ (c) $f(x) = \frac{e^x}{4}$

   (d) $f(x) = \sqrt{2}$ (e) $f(x) = \frac{1}{x}$ (f) $f(x) = 1 - x + e^x$

2. Confirm that $F(x) = \sin^2(2x)$ is an antiderivative of $f(x) = 4\sin(2x)\cos(2x)$.

| Function | Antiderivative |
|---|---|
| $x^k$ $(k \neq -1)$ | |
| $x^{-1}$ for all $x$ | |
| $1$ | |
| $\sin(x)$ | |
| $\cos(x)$ | |

| Function | Antiderivative |
|---|---|
| $e^x$ | |
| $1/(1+x^2)$ | |
| $\sec^2(x)$ | |
| $\sec(x)\tan(x)$ | |
| $1/\sqrt{1-x^2}$ | |

3. Evaluate the integrals.

   (a) $\int (e^{-x} + \sec^2(x))\, dx$

   (b) $\int \frac{x^2 + x^{1/2} + 1}{x^{1/2}}\, dx$

   (c) $\int (\frac{1}{4}x^4 + \sec(x/\pi)\tan(x/\pi))\, dx$

4. Solve the initial value problem if $f'(x) = x + e^x$ and $f(0) = 4$.

5. A particle moving along the $x$-axis has acceleration $a(t) = 10\sin(t)$ measured in $cm/s^2$. Assume the particle as initial velocity $v(0) = 0$ and initial position $s(0) = 0$, find a function that models its velocity, $v(t)$, and its position $s(t)$.