1. Compute $\lim_{x\to 3} \frac{x^2+2x-15}{x^2-4x+3}$.

2. Compute all real values of b such that, for $f(x)=x^2+bx-17$, $f(4)=f'(4)$.

3. Suppose a and b are real numbers such that

$$\lim_{x\to 0} \frac{\sin^2 x}{e^{ax}-bx-1} = \frac{1}{2}.$$

Determine all possible ordered pairs (a,b).

4. Evaluate $\int_0^4 e^{\sqrt{x}}\,dx$.

5. Evaluate $\lim_{x\to 0} \frac{\sin^2(5x)\tan^3(4x)}{(\log(2x+1))^5}$.

6. Compute $\sum_{k=0}^{\infty} \int_0^{\frac{\pi}{3}} \sin^{2k} x\,dx$.

7. The function $f(x)$ has the property that, for some real positive constant C, the expression

$$\frac{f^{(n)}(x)}{n+x+C}$$

is independent of n for all nonnegative integers n, provided that $n+x+C\neq 0$. Given that $f'(0)=1$ and $\int_0^1 f(x)\,dx = C+(e-2)$, determine the value of C.

Note: $f^{(n)}(x)$ is the n-th derivative of $f(x)$, and $f^{(0)}(x)$ is defined to be $f(x)$.

8. The function $f(x)$ is defined for all $x\geq 0$ and is always nonnegative. It has the additional property that if any line is drawn from the origin with any positive slope m, it intersects the graph $y=f(x)$ at precisely one point, which is $\frac{1}{\sqrt{m}}$ units from the origin. Suppose further that f has a unique maximum value at some real number $x=a$. Find $\int_0^a f(x)\,dx$.

9. Evaluate $\int_0^{\pi/2} \frac{dx}{\left(\sqrt{\sin x}+\sqrt{\cos x}\right)^4}$.

10. Evaluate $\lim_{n\to\infty}\left[\left(\prod_{k=1}^{n}\frac{2k}{2k-1}\right)\int_{-1}^{\infty}\frac{(\cos x)^{2n}}{2^x}\,dx\right]$.