1. Compute $\frac{dy}{dx}$ for the function:

   $y = \sinh^2 4x$

2. Evaluate the expression without a calculator to a value or to show that the value does not exist. Simplify the answer to the extent possible:

   $\sinh(2\ln 5)$

3. Find the area of the surface generated when the given curve is revolved about the x-axis:

   $y = \dfrac{x^3}{3} + \dfrac{1}{4x}$; from $x = 1$ to $x = 2$

4. Find the equation of the line tangent to the curve:

   $2x + \arctan y = y^2 - 1$; at the point $P(\dfrac{-\pi}{8}, -1)$

5. Evaluate:

   $\displaystyle\int \frac{x^2 + 3}{x\sqrt{x^2 - 4}} dx$

6. Compute $\frac{dy}{dx}$ for the function:

   $y = \ln \sinh 7x$

7. Find the length of the curve:

   $y = 3x^{\frac{3}{2}}$; from $x = 0$ to $x = \dfrac{5}{9}$

8. Evaluate or simplify:

   $\arccos\left(\cos\left(-\dfrac{\pi}{3}\right)\right)$

9. Evaluate:

   $\displaystyle\int_0^{\pi/4} \sin^3 4x \ dx$

10. Evaluate:

    $\displaystyle\int_0^{\ln 2} \cosh x \ dx$

11. Verify the identity using the definitions of hyperbolic functions:

    $\coth x = \dfrac{e^{2x} + 1}{e^{2x} - 1}$

12. Use integration by parts to establish a reduction formula for the integral:

    $\displaystyle\int x^n e^x dx$

13. Compute $\frac{dy}{dx}$ for the function:

    $y = \sinh^2 7x$

14. Evaluate:

    $\displaystyle\int \frac{-\csc\theta}{\csc\theta - \cot\theta} d\theta$

15. Use l'Hopital's rule to evaluate the limit:

    $\displaystyle\lim_{x\to\frac{\pi}{3}} \frac{\cos(x) - \frac{1}{2}}{x - \frac{x}{3}}$

16. Evaluate:

    $\displaystyle\int_2^4 8x \ln x \ dx$

17. Evaluate:

    $\displaystyle\int e^{2x} x^2 \ dx$

18. Evaluate:

    $\displaystyle\int_0^1 \frac{1}{\sqrt{16 - x^2}} dx$

19. Evaluate the limit:

    $\displaystyle\lim_{x\to\infty} x\left(\frac{\pi}{2} - \arctan x\right)$

20. Evaluate the integral:

    $\displaystyle\int \frac{2x}{x^2 + 6x + 13} dx$

21. Find the function $y = f(t)$ passing through the point $(0, 15)$ with the first derivate:

    $\dfrac{dy}{dt} = \dfrac{1}{4}t$

22. Find the derivative of $y$ with respect to $x$:

    $y = 3\arcsin(4x^3)$

23. Evaluate:

    $\displaystyle\int \frac{9}{\sqrt{64 - 81x^2}} dx$

24. Evaluate:

    $\arccos\left(-\dfrac{\sqrt{3}}{2}\right)$

25. Evaluate:

$$\int \frac{1}{x\sqrt{9x^2 - 6}}\,dx$$

26. Evaluate or simplify:

$$\cos(2\arccos x)$$

27. Differentiate:

$$y = \frac{1}{2}\left[x\sqrt{4 - x^4} + 4\arcsin\frac{x}{2}\right]$$

28. Evaluate the following without use of a calculator:

$$\coth(\ln 6)$$

29. Find the general solution of the equation:

$$y'(t) - \frac{y}{16} = -11$$

30. Evaluate:

$$\lim_{x \to -\infty} 4\sinh x$$

31. Evaluate:

$$\int -\operatorname{csch}^2 x \coth x\ dx$$

32. Find the exact value of the function:

$$\operatorname{arccsc}(-2)$$

33. Determine if the given function $y$ is a solution of the differential equation $y''$. Assume that $C$ is an arbitrary constant.

$$y = C_1 \sin 5t + C_2 \cos 5t; \quad y''(t) + 25y = 0$$

34. Evaluate:

$$\int \cos^2 \theta \sin 2\theta\ d\theta$$

35. A conservation organization releases 40 coyotes into a preserve. After 4 years, there are 70 coyotes in the preserve. The preserve has a carrying capacity of 175.

   a) Write a logistic function that models the population, $P(t)$, of coyotoes in the preserve.

   b) Use your answer from (a) to find $\lim_{t \to \infty} P(t)$

36. Evaluate:

$$\int \frac{\sinh x}{1 + \cosh x}\,dx$$

37. Compute $\frac{dy}{dx}$ for the function:

$$y = \sinh 7x$$

38. Find the exact value of the function:

$$\arcsin\left(-\frac{\sqrt{2}}{2}\right)$$

39. Evaluate:

$$\tan\left(\arccos\left(\frac{1}{2}\right)\right)$$

40. Find the general solution of the equation. Express the solution explicitly as a function of the independent variable:

$$e^{9t}y'(t) = -2$$