10. The volume of a square-bottomed box with no top has a volume of 500 cubic inches. The minimum possible surface area of the box is in which of the following intervals?

    (a) (265,295)
    (b) (305,335)
    (c) (345,375)
    (d) (385,415)
    (e) None of the above

11. For $g(x) = x(\ln x)^2$, evaluate the limit:
    $$\lim_{x \to e} \frac{g(x) - g(e)}{x - e}.$$

    (a) 1
    (b) 2
    (c) e
    (d) 3
    (e) None of the above

12. For what value of k does $\lim\limits_{x \to 2} \dfrac{x^2 + 3x + k}{x - 2}$ exist?

    (a) -10
    (b) -6
    (c) -2
    (d) 4
    (e) No such value exists

13. Which of the following integrals gives the length of the path described by parametric equations $x = t + \cos t, y(t) = t - \sin t, 0 \le t \le 2\pi$?

    (a) $\displaystyle\int_0^{2\pi} \sqrt{(1 - \sin t)^2 + (1 - \cos t)^2}\, dt$

    (b) $\displaystyle\int_0^{2\pi} \sqrt{(t + \cos t)^2 + (t - \sin t)^2}\, dt$

    (c) $\displaystyle\int_0^{2\pi} \sqrt{\left(\frac{t^2}{2} + \sin t\right)^2 + \left(\frac{t^2}{2} - \cos t\right)^2}\, dt$

    (d) $\displaystyle\int_0^{2\pi} \sqrt{1 + (1 - \sin t)^2}\, dt$

    (e) $\displaystyle\int_0^{2\pi} \sqrt{1 + (1 - \cos t)^2}\, dt$

14. Evaluate $\int \dfrac{\cot^3 t}{\csc t}\, dt$.

    (a) $-\csc t - \sin t + C$

    (b) $\frac{1}{4}\cot^4 t + C$

    (c) $-\csc t + C$

    (d) $-\frac{1}{4}\cos^4 + C$

    (e) None of the above

31. If you evaluate the integral $\int x^3 e^x\, dx$, what is the sum of the numerical coefficients of all terms other than the constant of integration?

    (a) -8

    (b) -2

    (c) 4

    (d) 16

    (e) None of the above

32. The integral $\int \dfrac{x^2\, dx}{\sqrt{x^2 - 4}}$ can be transformed into which of the following integrals using a trigonometric substitution?

    (a) $\int 4\sec^3 \theta\, d\theta$

    (b) $\int 4\sin^2 \theta\, d\theta$

    (c) $\int 4\tan^2 \theta \sec \theta\, d\theta$

    (d) $\int -4\cos^2 \theta\, d\theta$

    (e) None of the above

33. For a fixed constant $a > 0$, the power series

$$\sum_{n=1}^{\infty} \frac{(-1)^n (an)^2 (x - a)^n}{a^n}$$

converges on which of the following intervals?

    (a) $(-a, a)$

    (b) $(0, 2a)$

    (c) $(-1, 1)$

    (d) $(-a^2, a^2)$

    (e) $(-\infty, \infty)$