1. Cody is walking away from a street light that is 24 feet tall. If Cody is 6 feet tall and the length of his shadow is increasing at a rate of 2 feet per second, how fast is he walking away from the light?
A. 2 ft/sec B. 4 ft/sec C. 6 ft/sec D. 8 ft/sec E. NOTA

2. The lateral surface of a right circular cylinder is being marked in a lathe. The cylinder is rotating at an angular velocity of 3π radians per minute. The marker starts at one end of the cylinder and moves at a constant rate of 6 inches per minute in the same direction as the axis of the cylinder. If the cylinder has a radius of 2 inches and an axis length (height) of 15 inches, which of the following expressions represents the length in inches of the mark made on the lateral surface of the cylinder?
A. $15\sqrt{(1+\pi)}$ B. $\sqrt{15(1+\pi^2)}$ C. $15\sqrt{(1+\pi^2)}$ D. $15+15\pi$ E. NOTA

3. $\lim\limits_{x\to 0}\dfrac{\tan 2x}{x\cos x} =$
A. 0 B. $\dfrac{1}{2}$ C. 2 D. ∞ E. NOTA

4. Given: $y=\tan(x+y)$. Find $\dfrac{dy}{dx}$.
A. $\sec(x+y)\tan(x+y)$ B. $-\cot(x+y)\csc(x+y)$
C. $\sec^2(x+y)$ D. $-\csc^2(x+y)$ E. NOTA

5. $\lim\limits_{n\to\infty}\sum_{k=1}^{n}\left(\dfrac{1}{2+\frac{3k}{n}}\bullet\dfrac{3}{n}\right)$ is equivalent to which of the following definite integrals.
A. $\int_1^3 \dfrac{dx}{x}$ B. $\int_2^5 \dfrac{dx}{x}$ C. $\int_1^3 \dfrac{1}{2+x}dx$ D. $\int_1^2 \dfrac{dx}{x^2}$ E. NOTA

6. $\int\limits_0^{\pi}\sin^2 x dx =$
A. 0 B. $\dfrac{2}{3}$ C. $\dfrac{\pi}{3}$ D. $\dfrac{\pi}{2}$ E. NOTA

7. If the region bounded by $f(x)=4x-x^3$ and the x axis, were rotated about the y axis, the volume of the solid formed could be found most easily in a single integral by using the… (note: for those of you who plan to dispute this question because “most easily” is not a precise term. I’d think about it if I were you!)
A. disk method B. washer method C. shell method
D. method of finding the volume of a solid with known cross sections E. NOTA

8. $\int_2^5 |2x-9|dx =$
A. 6.5 B. 6.25 C. 6 D. -6 E. NOTA

9. Given: $\int_{0.081}^{1.372} \sec^2 x\,dx = 4.883$ (4 s. f.). To 4 s. f., what is $\int_{0.081}^{1.372} \tan^2 x\,dx$?

A. 3.592 B. 3.883 C. 4.883 D. 6.174 E. NOTA

10. Given: $y = x^x$. Find $\frac{dy}{dx}$.

A. $x\left(x^{x-1}\right)$ B. $x\ln x$ C. $x^x \ln x$ D. $x^x \ln x + x^x$ E. NOTA

11. Evaluate: $\lim_{x\to 2} \frac{\sqrt{2}-\sqrt{x}}{2-x}$

A. 0 B. $\frac{1}{\sqrt{2}}$ C. $\frac{1}{2}$ D. Does not exist E. NOTA

12. Find the y-coordinate of the centroid of the region bounded by the curves $y = x^3 - 2x^2 - 8x$, and $y = 4x - x^2$ where $x \geq 0$,

A. $\frac{160}{3}$ B. -5 C. $\frac{-872}{175}$ D. $\frac{-160}{3}$ E. NOTA

13. Let a curve be defined by the parametric equations, $x(t) = t^3, y(t) = t^5 - t^4$. Find $\frac{d^2y}{dx^2}$.

A. $\frac{10t-4}{9t^2}$ B. $\frac{10t-4}{3}$ C. $\frac{10}{3}$ D. $20t^3 - 12t^2$ E. NOTA

14. Evaluate: $\int_5^9 \sqrt{-x^2+10x-9}\,dx$

A. 2π B. 4π C. 8π D. 16π E. NOTA

15. Find the area enclosed by the graph of the polar equation: $r = 3\cos(3\theta)$.

A. $\frac{9\pi}{4}$ B. $\frac{9}{4}(\pi-1)$ C. $\frac{9}{4}(\pi+1)$ D. $\frac{9\pi}{2}$ E. NOTA

16. Let $\{a_n\}$ be a real valued sequence and $\lim_{n\to\infty} a_n = 0$. What conclusions can you draw.

A. $\sum_{n=1}^{\infty} a_n$ converges. B. $\sum_{n=1}^{\infty} a_n$ diverges. C. $\sum_{n=1}^{\infty} (-1)^n a_n$ converges

D. No conclusion can be drawn. E. NOTA

17. Evaluate: $\sum_{x=3}^{\infty} \frac{5}{x^2+5x}$ (hint: to look at Saturn's rings you would have to use a …)

A. $\frac{5}{24}$ B. $\frac{153}{140}$ C. $\frac{161}{360}$ D. ∞ E. NOTA

18. Test $\sum_{x=1}^{\infty}\frac{(-1)^x\sqrt{x^4-127x^2}}{\sqrt[3]{x^6+95x^5}}$ for convergence.

A. converges absolutely
B. converges conditionally
C. diverges
D. tests inconclusive
E. NOTA

19. Given: $y=\tan^2\sqrt{x}$. Find $\frac{dy}{dx}$.

A. $\tan\sqrt{x}\times\sec^2\sqrt{x}$
B. $2\tan\sqrt{x}\times\sec^2\sqrt{x}$
C. $\frac{\tan\sqrt{x}\times\sec^2\sqrt{x}}{\sqrt{x}}$
D. $\frac{2\tan\sqrt{x}\times\sec^2\sqrt{x}}{\sqrt{x}}$
E. NOTA

20. Find the equation of the line tangent to the curve $f(x)=\frac{x^3}{15}$ at $x=5$.

A. $15x+3y=50$
B. $15x-3y=50$
C. $15x+3y=100$
D. $15x-3y=100$
E. NOTA

21. John has decided he would like to climb mount Gaia. Mount Gaia is only 100 feet tall. Unfortunately, John is only able to climb one foot before nightfall so John must stop to rest. The next day, John is only able to climb ½ foot. The following day, John climbs ⅓ foot. Every day John climbs with his distance climbed on day "n" being $\frac{1}{n}$ foot. Complete the following sentence with the truest ending.

If John keeps this up every day, …

A) he will reach the top of Mt. Gaia in less than a year.
B) he will reach the top of Mt. Gaia in a lifetime of 70 years or less.
C) he would reach the top of Mt. Gaia if he were immortal.
D) he will never reach the top of Mt. Gaia.
E) NOTA

22. Find $\int_0^5 (x-2)^{-2}dx$

A. $\frac{-5}{6}$
B. $\frac{5}{6}$
C. $\frac{5}{6}+\frac{2}{2-b}$
D. Does not exist
E. NOTA

23. Find $\lim_{x\to-\infty}\frac{3-5x}{\sqrt{14x^2-27x}}$

A. $\frac{-5}{\sqrt{14}}$
B. $\frac{5}{\sqrt{14}}$
C. $-\infty$
D. ∞
E. NOTA

24. Find $\int x^2\sqrt{x+1}dx$

A. $\frac{2}{7}x^{\frac{7}{2}}+\frac{1}{3}x^3+C$
B. $\frac{2}{7}(x+1)^{\frac{7}{2}}+\frac{1}{3}(x+1)^3+C$
C. $\frac{2}{7}(x+1)^{\frac{7}{2}}-\frac{4}{5}(x+1)^{\frac{5}{2}}+\frac{2}{3}(x+1)^{\frac{3}{2}}+C$
D. $\ln(x+1)+C$
E. NOTA

25. Find $\int \frac{1}{e^{-x}+e^{x}}\,dx$

A. $\frac{1}{e^{-x}+e^{x}}+C$ B. cosh(x) + C C. arctan(e^{x}) + C D. $\ln\left(e^{-x}+e^{x}\right)+C$ E. NOTA

26. Test $\sum_{x=1}^{\infty}\frac{x\left(42^{x}\right)}{(7x)!}$ for convergence.

A. converges absolutely B. converges conditionally
C. diverges D. tests inconclusive E. NOTA

27. Find the interval of convergence for $\sum_{n=1}^{\infty}\frac{(x+5)^{n}}{11^{n}}$.

A. $x\in(-11,11)$ B. $x\in(-17,6)$ C. $x\in[-11,11)$ D. $x\in[-17,6)$ E. NOTA

For #28 through #30, let $P(x)=\begin{cases}\frac{k}{x+1}, & e-1\le x\le e^{4}-1\\ 0, & \text{otherwise}\end{cases}$ be a continuous probability density function.

28. What is the value of k ?

A. 1 B. $\frac{1}{3}$ C. 3
D. Not enough information to determine E. NOTA

29. For a randomly observed value (X) from the population, what is $P\left(2e-1\le X\le e^{3}-1\right)$?

A. $\frac{2}{3}-\ln\sqrt[3]{2}$ B. $1-\frac{1}{3}\ln 2$ C. $\ln\left(\sqrt[3]{e}-\sqrt[3]{2}\right)$ D. $\sqrt[3]{e}-\ln\sqrt[3]{2}$ E. NOTA

30. What is $E(X)$. (The expected value of a randomly observed X.)

A. $e(e-1)\left(e^{2}+e+1\right)$ B. $\frac{e^{4}-e}{3}$ C. $\frac{e^{4}-e}{3}$ - 1 D. $\frac{3}{2}$ E. NOTA