1. $\lim_{s\to\infty} \dfrac{2-3s+5s^2}{4-5s^3} =$

   A. $-\infty$

   B. -1

   C. 0

   D. $\dfrac{1}{2}$

   E. 1

2. If a ball is thrown upwards with a velocity of 52 ft/second, its height in feet after t seconds is $y = 52t - 16t^2$. Find the velocity after 2 seconds.

   A. 20 ft/sec upward

   B. 20 ft/sec downward

   C. 12 ft/sec upward

   D. 12 ft/sec downward

   E. 0 ft/sec

3. If $f(x) = x^2 \ln x$, then $f'(x) =$

   A. 2

   B. x

   C. $2x \ln x$

   D. $2x + \dfrac{1}{x}$

   E. $x(2\ln x + 1)$

4. If $f(x) = \dfrac{\sin x}{x}$, then $f'(x) =$

A. $-\dfrac{\cos x}{x^2}$

B. $-\dfrac{\sin x}{x^2}$

C. $-\dfrac{\sin x \cos x}{x^2}$

D. $\dfrac{x \cos x - \sin x}{x^2}$

E. $\dfrac{x \sin x - \cos x}{x^2}$

5. A spherical balloon is inflated in such a fashion that its radius increases at a rate of 0.5 cm/s. At a certain instant the radius is 3 cm. In cm^3/s, how fast is the volume increasing at that instant? (The volume of a sphere of radius r is $\frac{4}{3}\pi r^3$.)

A. 12π

B. 18π

C. 24π

D. 30π

E. 36π

6. If $f(x) = (x^3 + 1)^{10}$, then $f'(1) =$

A. $3 \cdot 2^9$

B. $6 \cdot 2^9$

C. $10 \cdot 2^9$

D. $20 \cdot 2^9$

E. $30 \cdot 2^9$

7. If $f(x) = \sqrt[3]{\sin(x^3)}$, then $f'(2) =$

A. $\cos 2$

B. $\frac{\cos 8}{3\sqrt[3]{\sin^2 8}}$

C. $\frac{4\cos 8}{3\sqrt[3]{\sin^2 8}}$

D. $\frac{4\cos 8}{\sqrt[3]{\sin^2 8}}$

E. $\frac{12\cos 8}{\sqrt[3]{\sin^2 8}}$

8. If $f'(8) = 5$ and $f'(2) = 7$, evaluate $\dfrac{d}{dx}\ f(2x^2)$ at $x = 2$.

A. 10

B. 20

C. 35

D. 40

E. 56

9. If $f(x) = \tan x$ then $f'''(x) =$

A. $4\sec^2 x \tan^2 x + 2\sec^4 x$

B. $4\sec^2 x \tan^2 x + \tan^4 x$

C. $2\sec^2 x \tan^2 x + 4\sec^4 x$

D. $4\sec^4 x \tan^2 x$

E. $2\sec^4 x$

10. The slope of the line tangent to the curve $x^2 + x^3y^2 - y^4 = 11$ at the point $(2, 1)$ is

A. $-\frac{1}{3}$

B. $-\frac{2}{3}$

C. -1

D. $-\frac{4}{3}$

E. 4

11. A particle moves along a straight line with equation of motion $s = t^3 - t^2$. Find the value of t at which the acceleration is zero.

A. $\frac{1}{4}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. $\frac{2}{3}$

E. $\frac{3}{2}$

12. Radium has a half life of 1600 years. How long does it take for 90% of a given amount of radium to decay?

A. $\frac{1600 \ln 10}{\ln 2}$

B. $\frac{1600 \ln 2}{\ln 10}$

C. $1600 \ln 5$

D. $1600 \ln 10$

E. $\frac{1600(\ln 10 - \ln 9)}{\ln 2}$

13. If $f(x) = e^{-3x} + 2x^{27} + 3x^2$. then the nineteen derivative of f evaluated at 0, $f^{(19)}(0) =$

A. 0

B. 1

C. -3^{19}

D. $-3^{19}e^{-3}$

E. $-3^{-19}e^{-3}$

14. The length of a rectangle is increasing at a rate of 2 feet per second, while the width is increasing at a rate of 1 foot per second. When the length is 5 feet and the width is 3 feet, how fast is the area increasing?

A. 2 ft^2/s

B. 6 ft^2/s

C. 10 ft^2/s

D. 11 ft^2/s

E. 13 ft^2/s