Show all work that leads to your answers!

6. $\frac{d}{dx}\left(\sin^3\left(x^2\right)\right) =$

(A) $\cos^3\left(x^2\right)$

(B) $3\sin^2\left(x^2\right)$

(C) $6x\sin^2\left(x^2\right)$

(D) $3\sin^2\left(x^2\right)\cos\left(x^2\right)$

(E) $6x\sin^2\left(x^2\right)\cos\left(x^2\right)$

7. $\lim_{x\to\infty}\frac{x^3}{e^{3x}}$ is

(A) 0 (B) $\frac{2}{9}$ (C) $\frac{2}{3}$ (D) 1 (E) infinite

8. Using the substitution $u = \sin(2x)$, $\int_{\pi/6}^{\pi/2}\sin^5(2x)\cos(2x)\,dx$ is equivalent to

(A) $-2\int_{1/2}^{1}u^5\,du$

(B) $\frac{1}{2}\int_{1/2}^{1}u^5\,du$

(C) $\frac{1}{2}\int_{0}^{\sqrt{3}/2}u^5\,du$

(D) $\frac{1}{2}\int_{\sqrt{3}/2}^{0}u^5\,du$

(E) $2\int_{\sqrt{3}/2}^{0}u^5\,du$

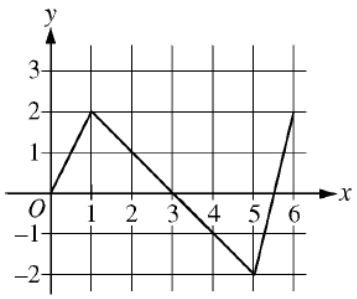
9. The function f has a first derivative given by $f'(x) = x(x-3)^2(x+1)$. At what values of x does f have a relative maximum?

(A) -1 only (B) 0 only (C) -1 and 0 only (D) -1 and 3 only (E) -1, 0, and 3

$$f(x) = \begin{cases} \dfrac{x^2 - 7x + 10}{b(x-2)} & \text{for } x \neq 2 \\ b & \text{for } x = 2 \end{cases}$$

10. Let f be the function defined above. For what value of b is f continuous at $x = 2$?

(A) -3 (B) $\sqrt{2}$ (C) 3 (D) 5 (E) There is no such value of b.



Graph of f'

11. For $0 \le x \le 6$, the graph of f', the derivative of f, is piecewise linear as shown above. If $f(0) = 1$, what is the maximum value of f on the interval?

(A) 1 (B) 1.5 (C) 2 (D) 4 (E) 6

12. Let f be the function given by $f(x) = 9^x$. If four subintervals of equal length are used, what is the value of the right Riemann sum approximation for $\int_0^2 f(x)\,dx$?

(A) 20 (B) 40 (C) 60 (D) 80 (E) 120

13. $\dfrac{d}{dx}\left(\dfrac{x+1}{x^2+1}\right) =$

(A) $\dfrac{x^2+2x-1}{\left(x^2+1\right)^2}$

(B) $\dfrac{-x^2-2x+1}{x^2+1}$

(C) $\dfrac{-x^2-2x+1}{\left(x^2+1\right)^2}$

(D) $\dfrac{3x^2+2x+1}{\left(x^2+1\right)^2}$

(E) $\dfrac{1}{2x}$

14. The velocity of a particle moving along the x-axis is given by $v(t) = \sin(2t)$ at time t. If the particle is at $x = 4$ when $t = 0$, what is the position of the particle when $t = \dfrac{\pi}{2}$?

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

15. The function $y = g(x)$ is differentiable and increasing for all real numbers. On what intervals is the function $y = g\left(x^3 - 6x^2\right)$ increasing?

(A) $(-\infty, 0]$ and $[4, \infty)$ only

(B) $[0, 4]$ only

(C) $[2, \infty)$ only

(D) $[6, \infty)$ only

(E) $(-\infty, \infty)$