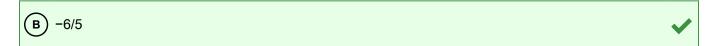
- 1. For $0 \le t \le 13$, an object travels along an elliptical path given by the parametric equations $x = 3\cos t$ and $y = 4\sin t$. At the point where t = 13, the object leaves the path and travels along the line tangent to the path at that point. What is the slope of the line on which the object travels?
- $\bigcirc A -\frac{4}{3}$
- \bigcirc B $-\frac{3}{4}$
- $\bigcirc -\frac{4\tan 13}{3}$
- $\bigcirc \hspace{-3mm} \hspace{$
- $\left(\mathsf{E}\right) \frac{3}{4\tan 13}$
- 2. A curve C is defined by the parametric equations $x = t^2 4t + 1$ and $y = t^3$. Which of the following is an equation of the line tangent to the graph of C at the point (-3, 8)?
- $\bigcirc A \quad x = -3$
- lacksquare B x=2
- (c) y=8
- (D) $y = -\frac{27}{10} (x+3) + 8$
- A curve is described by the parametric equations $x = t^2 + 2t$ and $y = t^3 + t^2$. An equation of the line tangent to the curve at the point determined by t = 1 is

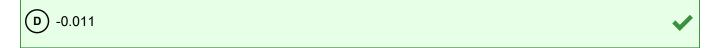
- (c) 4x y = 10
- (E) 5x y = 13
- 4. If $x=t^2-1$ and $y=2e^t$, then $\frac{dy}{dx}=$
- $igwedge A rac{e^t}{t}$
- \bigcirc B $\frac{2e^{t}}{t}$
- $\binom{c}{c} \frac{e^{|t|}}{t^2}$
- \bigcirc D $\frac{4e^t}{2t-1}$
- (E) e
- **5.** A particle moves along the curve xy=10. If x=2 and dy/dt=3, what is the value of dx/dt?

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- (c) (
- (D) 4/5
- (E) 6/5
- Consider the curve in the *xy*-plane represented by $x=e^t$ and $y=te^{-t}$ for $t \ge 0$. The slope of the line tangent to the curve at the point where x=3 is
- (A) 20.086
- (B) 0.342
- (c) -0.005



- E -0.033
- 7. If $x=e^{2t}$ and $y=\sin(2t)$, then $\frac{dy}{dx}=$

- \bigcirc $\frac{\sin(2\mathrm{t})}{2e^{2t}}$
- $oxed{\mathsf{E}} \ rac{\cos(2\mathsf{t})}{e^{2t}}$



- 8. For what values of t does the curve given by the parametric equations $x = t^3 t^2 1$. and $y = t^4 + 2t^2 8t$ have a vertical tangent?
- A 0 only
- B 1 only
- \bigcirc 0 and $\frac{2}{3}$ only



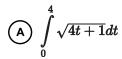
- \bigcirc 0, $\frac{2}{3}$, and 1
- (E) No value
- 9. A curve in the plane is defined parametrically by the equations $x=t^3+{\rm t}$ and $y=t^4+2t^2$ An equation of the line tangent to the curve at t=1 is

- \bigcirc y=2x
- \bigcirc y=8x
- \bigcirc y=2x-1
- \bigcirc y=4x-5
- \bigcirc y=8x+13
- **10.** If $x=t^2+1$ and $y=t^3$, then ${
 m d}^2{
 m y}/{
 m d}{
 m x}^2$ =
- A 3/4t
- B) 3/2t
- (c) 3t
- (D) 6t
- **E**) 3/2
- 11. The length of a curve from x = 1 to x = 4 is given by $\int_1^4 \sqrt{1 + 9x^4} dx$. If the curve contains the point (1, 6), which of the following could be an equation for this curve?

- $(A) y = 3 + 3x^2$
- $\bigcirc y = 6 + x^3$
- $\bigcirc D y = 6 x^3$
- (E) $y = \frac{16}{5} + x + \frac{9}{5}x^5$
- **12.** Which of the following integrals gives the length of the graph $y = \sin(\sqrt{x})$ between x = a and x = b, where 0 < a < b?
- (B) $\int_a^b \sqrt{1+\cos^2(\sqrt{x})}dx$
- $\bigcirc \int_a^b \sqrt{\sin^2(\sqrt{x}) + \frac{1}{4x}\cos^2(\sqrt{x})} dx$
- $\bigcirc \hspace{-0.5cm} \mathsf{D} \hspace{0.5cm} \int_a^b \sqrt{1 + \frac{1}{4x} \mathrm{cos}^2(\sqrt{x})} dx \hspace{1cm} \checkmark \hspace{1cm}$
- **13.** The length of the curve $y=\ln\sec x$ from x=0 to x=b, where $0 < b < \frac{\pi}{2}$, may be expressed by which of the following integrals?

- $\bigcirc \hspace{-0.5cm} \bigwedge \limits_{0}^{b} \sec x dx$
- $\bigcirc \int_{0}^{b} (\sec x \tan x) dx$
- $\bigcirc \int\limits_0^b \sqrt{1+\left(\ln\sec x\right)^2} dx$
- $(\mathsf{E}) \int\limits_0^b \sqrt{1 + (\sec^2 x \mathrm{tan}^2 x)} dx$
- 14. Which of the following gives the length of the path described by the parametric equations $x = \sin(t^3)$ and $y = e^{5t}$ fromt=0 tot= π ?
- (B) $\int_{0}^{\pi} \sqrt{\cos^{2}(t^{3}) + e^{10t}} dt$
- $\bigcirc \bigcirc \int_0^\pi \sqrt{9t^4 \cos^2{(t^3)} + 25e^{10t}} \ dt$
- $(\mathbf{E}) \ \int_0^\pi \sqrt{\cos^2 \left(3t^2 \right) + e^{10t}} \ dt$
- **15.** The length of the curve determined by the equations $x = t^2$ and y=t from t=0 to t=4 is

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$$\bigcirc \int\limits_{0}^{4}\sqrt{2l^{2}+1}dt$$

$$iggl[egin{array}{c} iggr] \int\limits_0^4 \sqrt{4t^2+1}dt \end{array}$$



$$igorplus 2\pi \int\limits_0^4 \sqrt{4l^2+1}dt$$

- **16.** The length of the path described by the parametric equations $x=\cos^3 t$ and $y=\sin^3 t$, for $0\leq t\leq \frac{\pi}{2}$ is given by

- $\bigcirc \int_0^{\frac{\pi}{2}} \sqrt{9\cos^4 t + 9\sin^4 t} dt$
- $\bigcirc \int_0^{\frac{\pi}{2}} \sqrt{9 \text{cos}^4 t \text{sin}^2 t + 9 \text{sin}^4 t \text{cos}^2 t} dt$



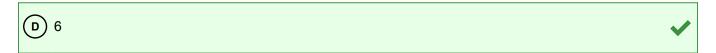
$$(E) \int_0^{\frac{\pi}{2}} \sqrt{\cos^6 t + \sin^6 t} dt$$

17. At timet \geq 0, a particle moving in the xy-plane has velocity vector given by $v\left(t\right)=\left\langle t^{2},\ 5t\right\rangle$. What is the acceleration vector of the particle at timet=3?





- \bigcirc $\langle 2, 0 \rangle$
- \bigcirc $\sqrt{306}$
- $(E) \sqrt{61}$
- 18. In the *xy*-plane, a particle moves along the parabola $y=x^2-x$ with a constant speed of $2\sqrt{10}$ units per second. If $\frac{dx}{dt}>0$, what is the value of $\frac{dy}{dt}$ when the particle is at the point (2, 2)?
- $\bigcirc A \quad \frac{2}{3}$
- (c) 3



- (E) $6\sqrt{10}$
- **19.** A particle moves on the curve $y=\ln x$ so that the x-component has velocity x'(t)=t+1 for $t\geq 0$. At time t=0, the particle is at the point (1, 0). At time t=1, the particle is at the point

- (2,ln2)
- (B) $(e^2,2)$
- $\bigcirc (\frac{5}{2}, \ln \frac{5}{2})$
- (D) (3, ln3)
- $(\frac{3}{2}, \ln \frac{3}{2})$
- **20.** A particle moves in the xy-plane so that at any time t its coordinates are $x=t^2-1$ and $y=t^4-2t^3$ At t=1, its acceleration vector is
- **A** (0,-1)
- **B** (0,12)
- (2, -2)
- D (2,0)
- (E) (2,8)
- **21.** If a particle moves in the *xy*-plane so that at time t>0 its position vector is $(\ln(t^2+2t), 2t^2)$, then at time t=2, its velocity vector is





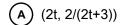
- $\bigcirc B) (\frac{3}{4}, 4)$
- $\binom{1}{8}, 8$
- $\binom{1}{8}$ $(\frac{1}{8}, 4)$
- $(E) \left(-\frac{5}{16},4\right)$
- **22.** A particle moves on a plane curve so that at any time t>0 its x-coordinate is t^3-t and its y-coordinate is $(2t-1)^3$. The acceleration vector of the particle at t=1 is
- **A** (0,1)
- **B** (2,3)
- (c) (2,6)
- **D** (6,12)





23. For any timet ≥ 0 , if the position of a particle in the xy-plane is given by $x=t^2+1$ and $y=\ln(2t+3)$, then the acceleration vector is

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- C (2, 4/(2t+3)²)

