AP problem #7 Key

1. Velocity = $y'(t) = 4t^3 - 36t = 4t(t^2 - 9)$ Sign chart for velocity: --- -3 +++ 0 --- 3 +++

   Acceleration = $y''(t) = 12t^2 - 36 = 12(t^2 - 3)$ Sign chart for acceleration: +++ $-\sqrt{3}$ --- $\sqrt{3}$ +++

   The object is speeding up when both velocity and acceleration have the same signs. You could also graph velocity. When velocity is positive and increasing or negative and decreasing, the object is speeding up. Answer: B $0 < t < \sqrt{3}$ and $3 < t < 5$

---

2. Since $\int_a^d f(x)\,dx = -7$ and $\int_b^d f(x)\,dx = -2$, then region P has area of -5. $\int_c^a f(x)\,dx = 17$, so $\int_a^c f(x)\,dx = -17$ making region Q -12. Answer: A

---

3. $\int_{-2}^{5} |x+1|\,dx = \int_{-2}^{-1} (-x-1)\,dx + \int_{-1}^{5} (x+1)\,dx$.

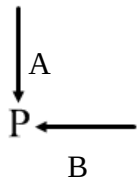
   $-\frac{1}{2}x^2 - x\Big|_{-2}^{-1} = \left(-\frac{1}{2}+1\right) - (-2+2) = \frac{1}{2}$

   $\frac{1}{2}x^2 + x\Big|_{-1}^{5} = \left(\frac{25}{2}+5\right) - \left(\frac{1}{2}-1\right) = 18$

   Answer: C

---

4. $A^2 + B^2 = C^2$ $\quad 2A\frac{dA}{dt} + 2B\frac{dB}{dt} = 2C\frac{dC}{dt}$ $\quad (12)(-60) + (10)(-50) = C\frac{dC}{dt}$

   $\frac{dC}{dt} = \frac{(12)(-60) + (10)(-50)}{\sqrt{12^2 + 10^2}}$, Answer: D

---

5. Velocity = $x'(t) = 3 - 3t^2$, $\quad x'(4) = 3 - 3(4)^2 = -45$ Answer: D

---

6. $k'(x) = f'\left(g\left(x^2\right)\right) \cdot g'\left(x^2\right) \cdot 2x$, $\quad k'(2) = f'(g(4)) \cdot g'(4) \cdot 4 = f'(1) \cdot \left(\frac{1}{2}\right) \cdot 4 = \frac{2}{3} \cdot \left(\frac{1}{2}\right) \cdot 4 = \frac{4}{3}$

   Answer: C

---

7. $v(t) = t - \sqrt[3]{t}$, $\quad s(t) = \frac{1}{2}t^2 - \frac{3}{4}t^{4/3} + C$, $\quad s(t) = \frac{1}{2}t^2 - \frac{3}{4}t^{4/3} - 4$, $\quad s(8) = \frac{1}{2}(8)^2 - \frac{3}{4}(8)^{4/3} - 4 = 16$

   Answer: C