Classroom Voting Questions: Calculus I

2.4 Interpretations of the Derivative

1. The radius of a snowball changes as the snow melts. The instantaneous rate of change in radius with respect to volume is

   (a) $\frac{dV}{dr}$
   (b) $\frac{dr}{dV}$
   (c) $\frac{dV}{dr} + \frac{dr}{dV}$
   (d) None of the above

2. Gravel is poured into a conical pile. The rate at which gravel is added to the pile is

   (a) $\frac{dV}{dt}$
   (b) $\frac{dr}{dt}$
   (c) $\frac{dV}{dr}$
   (d) None of the above

3. A slow freight train chugs along a straight track. The distance it has traveled after x hours is given by a function $f(x)$. An engineer is walking along the top of the box cars at the rate of 3 mi/hr in the same direction as the train is moving. The speed of the man relative to the ground is

   (a) $f(x) + 3$
   (b) $f'(x) + 3$
   (c) $f(x) - 3$
   (d) $f'(x) - 3$

4. $C(r)$ gives the total cost of paying off a car loan that has an annual interest rate of r %. What are the units of $C'(r)$?

   (a) Year / \$
   (b) \$ / Year
   (c) \$ / %
   (d) % / \$

5. $C(r)$ gives the total cost of paying off a car loan that has an annual interest rate of r %. What is the practical meaning of $C'(5)$?

   (a) The rate of change of the total cost of the car loan is $C'(5)$.

   (b) If the interest rate increases by 1%, then the total cost of the loan increases by $C'(5)$.

   (c) If the interest rate increases by 1%, then the total cost of the loan increases by $C'(5)$ when the interest rate is 5%.

   (d) If the interest rate increases by 5%, then the total cost of the loan increases by $C'(5)$.

6. $C(r)$ gives the total cost of paying off a car loan that has an annual interest rate of r %. What is the sign of $C'(5)$?

   (a) Positive

   (b) Negative

   (c) Not enough information is given

7. $g(v)$ gives the fuel efficiency, in miles per gallon, of a car going a speed of v miles per hour. What are the units of $g'(v) = \frac{dg}{dv}$?

   (a) $(\text{miles})^2/[(\text{gal})(\text{hour})]$

   (b) hour/gal

   (c) gal/hour

   (d) $(\text{gal})(\text{hour})/(\text{miles})^2$

8. $g(v)$ gives the fuel efficiency, in miles per gallon, of a car going a speed of v miles per hour. What is the practical meaning of $g'(55) = -0.54$?

   (a) When the car is going 55 mph, the rate of change of the fuel efficiency decreases to 0.54 miles/gal.

   (b) When the car is going 55 mph, the rate of change of the fuel efficiency decreases by 0.54 miles/gal.

   (c) If the car speeds up from 55 to 56 mph, then the fuel efficiency is 0.54 miles per gallon.

   (d) If the car speeds up from 55 to 56 mph, then the car becomes less fuel efficient by 0.54 miles per gallon.