

2. [8 points] Octavia wants to inflate her front bicycle tire with her new air compressor, so she attaches the compressor to her tire and turns it on. Let $V(t)$ represent the total volume of air, in cubic inches, that the compressor has pumped into the tire t seconds after the compressor has been switched on, and let $P(s)$ be the air pressure, in pounds per square inch (psi), inside the tire when it has been filled with s cubic inches of air. Assume both functions are invertible and differentiable.

- a. [2 points] Write a complete sentence that gives a practical interpretation of the equation

$$P^{-1}(90) = 200.$$

Solution: When the tire has been filled with 200 cubic inches of air, the pressure inside of it is 90 psi.

- b. [2 points] Write a complete sentence that gives a practical interpretation of the equation

$$P(V(30)) = 90.$$

Solution: Thirty seconds after Octavia switched on the air compressor, the pressure inside the tire is 90 psi.

- c. [1 point] Assuming the equations in parts (a) and (b) are true, how many cubic inches of air has the compressor pumped into the tire after it has been running for 30 seconds?

Answer: 200

- d. [3 points] Circle **all** valid practical interpretations of the equation

$$V'(20) = 10.$$

- i.* In the first 20 seconds it is running, the air compressor pumps about 10 cubic inches of air.
- ii.* Twenty seconds after the air compressor started running, if Octavia runs it for another 10 seconds, the total volume it has pumped will increase by about 1 cubic inch per second.
- iii.* In the twentieth second after Octavia turns on her air compressor, the total volume of air that it has pumped increases by about 10 cubic inches.
- iv.* When 20 cubic inches of air have been pumped, the air compressor is pumping air at a rate of about 10 cubic inches per second.
- v.* After the air compressor has been running for 20 seconds, the compressor will pump about 10 cubic inches of air in the next second.