9. [11 points] A spherical balloon begins to inflate with air at time $t = 0$, after which time its radius r, volume V, and surface area A increase. Recall that the volume V and surface area A of a sphere of radius r are given by $V = \frac{4}{3}\pi r^3$ and $A = 4\pi r^2$.

a. [5 points] At what rate is air being blown into the balloon when the balloon's radius is 10 cm and its radius is growing at a rate of 2 cm per second? *Include units.*

Answer: ________________________

Suppose the volume V and surface area A of the balloon t seconds after it begins to inflate are given by $V = f(t)$ and $A = g(t)$. These functions are invertible, and the function $h(V)$ defined by $h(V) = g\big(f^{-1}(V)\big)$ gives the balloon's surface area as a function of its volume.

b. [3 points] Using the given table of values, find $h'(8)$. Your answer must be a *number*, but need not be simplified.

t	1	8
r	1.24	2.48
$f(t)$	8	64
$g(t)$	19.34	77.38
dr/dt	0.41	0.10
$f'(t)$	8	8
$g'(t)$	12.90	6.45

Answer: $h'(8) =$ ________________________

c. [3 points] Circle the **<u>one</u>** statement below that is best supported by the equation

$$(h^{-1})'(50) = \frac{1}{4}.$$

i. When the balloon's surface area is 50 cm^2, its volume is 0.25 cm^3.

ii. When the balloon's surface area is 50 cm^2, its surface area is increasing at about $\frac{1}{4}$ the rate at which its volume is increasing.

iii. When the balloon's surface area is 52 cm^2, the balloon is about one cubic centimeter larger in volume than it was when its surface area was 48 cm^2.

iv. The balloon's surface area increases by about 0.25 cm^2 during the time when its volume increases from 50 to 51 cm^3.

v. The balloon's volume increases by about 4 cm^3 during the time when its surface area increases from 50 to 51 cm^2.