16. (a) $v(1) = \lim_{h\to 0} \dfrac{H(1+h) - H(1)}{h}$

$$= \lim_{h\to 0} \frac{(58 + 58h - 0.83 - 1.66h - 0.83h^2) - 57.17}{h} = \lim_{h\to 0} (56.34 - 0.83h) = 56.34 \text{ m/s}$$

(b) $v(a) = \lim_{h\to 0} \dfrac{H(a+h) - H(a)}{h}$

$$= \lim_{h\to 0} \frac{(58a + 58h - 0.83a^2 - 1.66ah - 0.83h^2) - (58a - 0.83a^2)}{h}$$

$$= \lim_{h\to 0} (58 - 1.66a - 0.83h) = 58 - 1.66a \text{ m/s}$$

(c) The arrow strikes the moon when the height is 0, that is, $58t - 0.83t^2 = 0 \iff t(58 - 0.83t) = 0 \iff t = \frac{58}{0.83} \approx 69.9$ s (since t can't be 0).

(d) Using the time from part (c), $v\left(\frac{58}{0.83}\right) = 58 - 1.66\left(\frac{58}{0.83}\right) = -58$ m/s. Thus, the arrow will have a velocity of -58 m/s.

17. $v(a) = \lim_{h\to 0} \dfrac{s(a+h) - s(a)}{h} = \lim_{h\to 0} \dfrac{4(a+h)^3 + 6(a+h) + 2 - (4a^3 + 6a + 2)}{h}$

$$= \lim_{h\to 0} \frac{4a^3 + 12a^2h + 12ah^2 + 4h^3 + 6a + 6h + 2 - 4a^3 - 6a - 2}{h}$$

$$= \lim_{h\to 0} \frac{12a^2h + 12ah^2 + 4h^3 + 6h}{h} = \lim_{h\to 0} (12a^2 + 12ah + 4h^2 + 6) = (12a^2 + 6) \text{ m/s}$$

So $v(1) = 12(1)^2 + 6 = 18$ m/s, $v(2) = 12(2)^2 + 6 = 54$ m/s, and $v(3) = 12(3)^2 + 6 = 114$ m/s.

18. (a) The average velocity between times t and $t+h$ is

$$\frac{s(t+h) - s(t)}{(t+h) - t} = \frac{(t+h)^2 - 8(t+h) + 18 - (t^2 - 8t + 18)}{h}$$

$$= \frac{t^2 + 2th + h^2 - 8t - 8h + 18 - t^2 + 8t - 18}{h} = \frac{2th + h^2 - 8h}{h}$$

$$= (2t + h - 8) \text{ m/s}$$

(i) $[3, 4]$: $t = 3$, $h = 4 - 3 = 1$, so the average velocity is $2(3) + 1 - 8 = -1$ m/s.

(ii) $[3.5, 4]$: $t = 3.5$, $h = 0.5$, so the average velocity is $2(3.5) + 0.5 - 8 = -0.5$ m/s.

(iii) $[4, 5]$: $t = 4$, $h = 1$, so the average velocity is $2(4) + 1 - 8 = 1$ m/s.

(iv) $[4, 4.5]$: $t = 4$, $h = 0.5$, so the average velocity is $2(4) + 0.5 - 8 = 0.5$ m/s.

(b) $v(t) = \lim_{h\to 0} \dfrac{s(t+h) - s(t)}{h}$

$= \lim_{h\to 0} (2t + h - 8) = 2t - 8$,

so $v(4) = 0$.

(c)