

12203

$$6(5) = 30$$

2.

a.

$$\begin{aligned} L_6: A &= 2 \cdot (f(1) + f(2) + f(4) + f(6) + f(8) + f(10)) \\ &= 2 \cdot (9 + 8.8 + 8.2 + 7.2 + 6 + 4) \\ &= 2(43.2) = \boxed{86.4} \end{aligned}$$

$$\begin{aligned} R_6 &= 2(f(2) + f(4) + f(6) + f(8) + f(10) + f(12)) \\ &= 2(8.8 + 8.2 + 7.2 + 6 + 4 + 1) = \del{70.4} \boxed{70.4} \end{aligned}$$

$$\begin{aligned} M_6 &= 2(f(1) + f(3) + f(5) + f(7) + f(9) + f(11)) \\ &= 2(8.9 + 8.5 + 7.8 + 6.5 + 5 + 2.5) = \boxed{78.4} \end{aligned}$$

b.  $L_6$  is an overestimate since the rectangles strictly contain the area under the curve.

c.  $R_6$  is an underestimate, all the rectangles are below the curve.

d. It seems likely that  $M_6$  is the best estimate but this is not clear, maybe the actual area is 72 for example.

8a  $12(30+28+25+22+24) = 12(129) = 1548 \text{ ft}$

b  $12(28+25+22+24+27) = 12(126) = 1512 \text{ ft}$

c. The speed goes up and down. Thus the right/left endpoints do not give consistently over or underestimates. Thus these are not overestimates or underestimates.

13)  $n$  rectangles, base is  $15/n$ , using right endpoints we get

$$x_1 = 1 + \frac{15}{n}, x_2 = 1 + 2 \cdot \frac{15}{n}, \dots, x_n = 1 + n \cdot \frac{15}{n}$$

$$\text{estimated Area} = \frac{15}{n} \sum_{i=1}^n \sqrt[4]{1 + \frac{15i}{n}}$$

$$\text{Area} = \lim_{n \rightarrow \infty} \left( \frac{15}{n} \cdot \sum_{i=1}^n \sqrt[4]{1 + \frac{15i}{n}} \right)$$

14) As in #13

$$\text{Area} = \lim_{n \rightarrow \infty} \frac{3}{n} \sum_{i=1}^n \left( 1 + \left( 2 + \frac{3i}{n} \right)^4 \right)$$

#13 Using left endpoints we would get

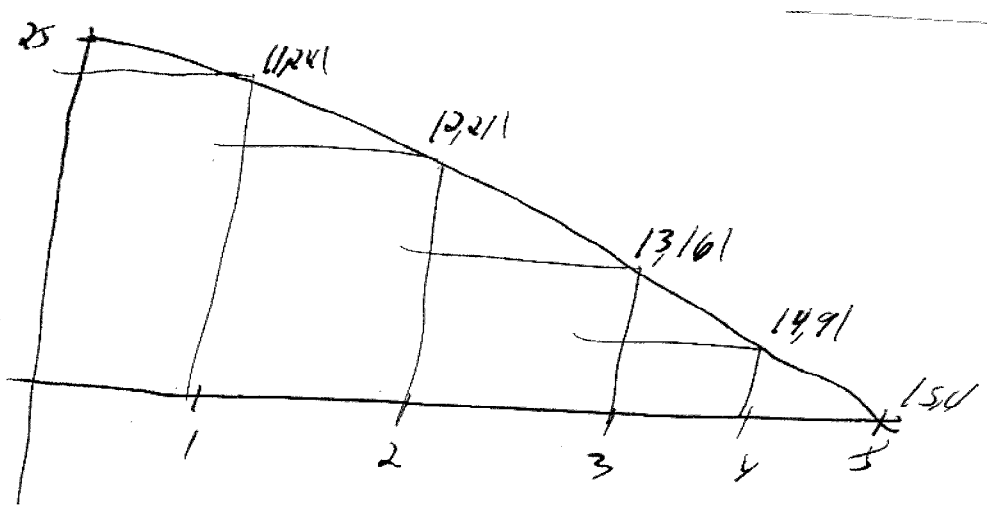
$$\lim_{n \rightarrow \infty} \frac{15}{n} \sum_{i=0}^{n-1} \sqrt[4]{1 + \frac{15i}{n}}$$

#14

1 1 1 1 1

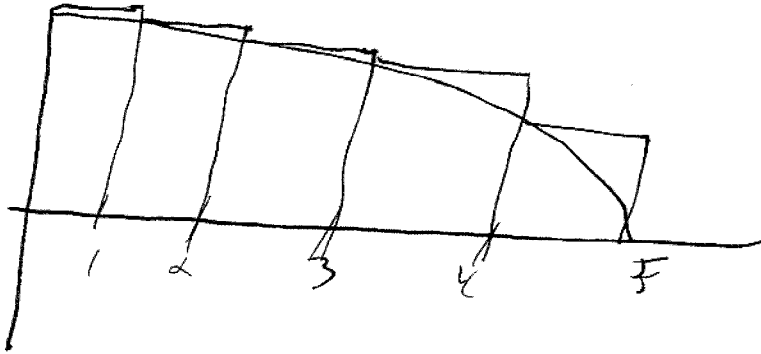
$$\lim_{n \rightarrow \infty} \frac{3}{n} \sum_{i=0}^{n-1} \left( 1 + \left( 2 + \frac{3i}{n} \right)^4 \right)$$

4 a.



$$R_5 = 1.24 + 1.21 + 1.16 + 1.9 + 1.0 = 70$$

b.



$$L_5 = 1.25 + 1.24 + 1.21 + 1.16 + 1.9 = 95$$

7.

$$\begin{aligned} \text{Lower estimate} &: .5(0 + 6.2 + 10.8 + 14.9 + 18.1 + 19.4) \\ &= .5(69.4) = 34.7 \text{ ft} \end{aligned}$$

using left hand  
end points

$$\begin{aligned} \text{Upper estimate} &: .5(6.2 + 10.8 + 14.9 + 18.1 + 19.4 + 20.2) \\ &= .5(89.6) = 44.8 \text{ ft} \end{aligned}$$