

1. Use the forward-difference formulas and backward-difference formulas to determine each missing entry in the following tables.

a.

| x | $f(x)$ | $f'(x)$ |
|-----|--------|---------|
| 0.5 | 0.4794 | |
| 0.6 | 0.5646 | |
| 0.7 | 0.6442 | |

b.

| x | $f(x)$ | $f'(x)$ |
|-----|---------|---------|
| 0.0 | 0.00000 | |
| 0.2 | 0.74140 | |
| 0.4 | 1.3718 | |

(a) Using forward-difference we have

$$f'(0.5) = \frac{f(0.6) - f(0.5)}{0.6 - 0.5} = 0.852.$$

$$f'(0.6) = \frac{f(0.7) - f(0.6)}{0.7 - 0.6} = 0.796.$$

Using backward-difference we have

$$f'(0.6) = \frac{f(0.5) - f(0.6)}{0.5 - 0.6} = 0.852.$$

$$f'(0.7) = \frac{f(0.6) - f(0.7)}{0.6 - 0.7} = 0.796.$$

(b) Using forward-difference we have

$$f'(0) = \frac{f(0.2) - f(0)}{0.2 - 0.0} = 3.707.$$

$$f'(0.2) = \frac{f(0.4) - f(0.2)}{0.4 - 0.2} = 3.152.$$

Using backward-difference we have

$$f'(0.2) = \frac{f(0) - f(0.2)}{0 - 0.2} = 3.707.$$

$$f'(0.4) = \frac{f(0.2) - f(0.4)}{0.2 - 0.4} = 3.152.$$

5. Use the most accurate three-point formula to determine each missing entry in the following tables.

a.

| x | $f(x)$ | $f'(x)$ |
|-----|----------|---------|
| 1.1 | 9.025013 | |
| 1.2 | 11.02318 | |
| 1.3 | 13.46374 | |
| 1.4 | 16.44465 | |

b.

| x | $f(x)$ | $f'(x)$ |
|-----|----------|---------|
| 8.1 | 16.94410 | |
| 8.3 | 17.56492 | |
| 8.5 | 18.19056 | |
| 8.7 | 18.82091 | |

By Three-point endpoint formula:

Here $h = 0.1$

$$\begin{aligned} f'(1.1) &= \frac{1}{2(0.1)}[-3f(1.1) + 4f(1.2) - f(1.3)] \\ &= \frac{1}{0.2}[-3(9.025013) + 4(11.02318) - 16.44] \end{aligned}$$

$$\boxed{f'(1.1) = 2.865155}$$

By Three-point mid-point formula:

Here $h = 0.1$

$$\begin{aligned} f'(1.2) &= \frac{1}{2(0.1)}[f(1.3) - f(1.1)] \\ &= \frac{13.46374 - 9.025013}{0.2} \end{aligned}$$

$$\boxed{f'(1.2) = 22.193635}$$

By Three-point mid-point formula:

$$\begin{aligned} f'(1.3) &= \frac{f(1.4) - f(1.2)}{2(0.1)} \quad (h = 0.1) \\ \therefore f'(1.3) &= \frac{16.44465 - 11.02318}{2(0.1)} \end{aligned}$$

$$\boxed{f'(1.3) = 27.10735}$$

By three-point endpoint formula:

here, $h = -0.1$

$$\begin{aligned} f'(1.4) &= \frac{1}{2(-0.1)}[-3f(1.4) + 4f(1.3) - f(1.2)] \\ &= \frac{(-3)(16.44465) + 4(13.46374) - 11.02318}{-0.2} \end{aligned}$$

$$\boxed{f'(1.4) = 32.51085}$$
