1. Given $f(x) = x^4 - 2x^3 + 3x^2 - 4x + 5$, use synthetic division to evaluate a) $f(-2)$ and b) $f(3)$.

2. Evaluate a) $\binom{8}{3}$ and b) $\binom{30}{28}$

   (a)

$$\begin{aligned}\binom{8}{3} &= \frac{8!}{3!(8-3)!} \\ &= \frac{8!}{3!\cdot 5!} \\ &= \frac{6\cdot 7\cdot 8}{3\cdot 2} \\ &= \frac{336}{6} \\ &= 56\end{aligned}$$

   (b)

$$\begin{aligned}\binom{30}{28} &= \frac{30!}{28!(30-28)!} \\ &= \frac{29\cdot 30}{2} \\ &= 435\end{aligned}$$

3. Given the sequence: 1, 5, 9, 13, $\cdots$, 97

   (a) Find the 20th term; (a=1, d=4, n=20)

$$\begin{aligned}x_n &= a + d(n-1) \\ x_{20} &= 1 + 4(20-1) \\ x_{20} &= 77\end{aligned}$$

   (b) Find the sum of all terms in the sequence. First find n where $x_n = 97$:

$$\begin{aligned}97 &= 1 + 4(n-1) \\ 97 &= 1 + 4n - 4 \\ 97 &= 4n - 3 \\ 100 &= 4n \\ n &= 25 \\ S &= \frac{n}{2}(2a + d(n-1)) \\ S &= \frac{25}{2}(2\cdot 1 + 4(25-1) \\ &12.5\cdot 2 + 12.5\cdot 96 \\ S &= 1225\end{aligned}$$

4. Given the sequence 2,6,18,54

   (a) Find the 10th term ($a = 2$,r=3, n=10)

$$\begin{aligned} x_n &= ar^{n-1} \\ x_{10} &= 2 \cdot 3^{10-1} \\ & 2 \cdot 3^9 \\ x_{10} &= 39366 \end{aligned}$$

   (b) Find the sum of the first 10 terms

$$\begin{aligned} S &= a(\frac{1-r^n}{1-r}) \\ & 2(\frac{1-3^{10}}{1-3}) \\ S &= 59048 \end{aligned}$$

5. Solve each inequality below

   (a)

$$\begin{aligned} -5x &< 10 \\ x &< -2 \end{aligned}$$

   (b)

$$\begin{aligned} x^2 - 10x + 21 < 0 \\ (x-7)(x-3) < 0 \\ 3 < x < 7 \end{aligned}$$

   (c)

$$\begin{aligned} x^2 + x - 42 > 0 \\ (x-6)(x+7) > 0 \\ x < -7, x > 6 \end{aligned}$$

6. If $f(x) = \frac{x+1}{x-1}$ and $g(x) = \frac{1}{x}$,find f(g(x)) and g(f(x))

$$\begin{aligned} f(g(x)) = & \frac{\frac{1}{x}+1}{\frac{1}{x}-1} \\ & \frac{1+x}{1-x} \\ g(f(x)) = & \frac{1}{\frac{x+1}{x-1}} \\ & \frac{x-1}{x+1} \end{aligned}$$

7. If $f(x) = \sqrt[3]{2x-5}$, find $f^{-1}(x)$

$$\begin{aligned} \sqrt[3]{2x-5} &= y \\ 2x-5 &= y^3 \\ x &= \frac{y^3+5}{2} \end{aligned}$$