

9.4.1 EXERCISES

For a link to all of the additional resources available for this section, click [OSttS Chapter 9 materials](#).

In Exercises 1 - 9, simplify the given expression.

For help with these exercises, click the resource below:

- [Performing operations with factorials](#)

1. $(3!)^2$	2. $\frac{10!}{7!}$	3. $\frac{7!}{2^3 3!}$
4. $\frac{9!}{4!3!2!}$	5. $\frac{(n+1)!}{n!}, n \geq 0.$	6. $\frac{(k-1)!}{(k+2)!}, k \geq 1.$
7. $\binom{8}{3}$	8. $\binom{117}{0}$	9. $\binom{n}{n-2}, n \geq 2$

For help with Exercises 10 - 17, click on one or more of the resources below:

- [Constructing Pascal's Triangle](#)
- [Using Pascal's Triangle to expand a polynomial](#)

In Exercises 10 - 13, use Pascal's Triangle to expand the given binomial.

10. $(x+2)^5$	11. $(2x-1)^4$	12. $\left(\frac{1}{3}x+y^2\right)^3$	13. $(x-x^{-1})^4$
---------------	----------------	---------------------------------------	--------------------

In Exercises 14 - 17, use Pascal's Triangle to simplify the given power of a complex number.

14. $(1+2i)^4$	15. $(-1+i\sqrt{3})^3$
16. $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^3$	17. $\left(\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}i\right)^4$

In Exercises 18 - 22, use the Binomial Theorem to find the indicated term.

For help with these exercises, click the resource below:

- [Using the Binomial Theorem](#)

18. The term containing x^3 in the expansion $(2x-y)^5$
19. The term containing x^{117} in the expansion $(x+2)^{118}$
20. The term containing $x^{\frac{7}{2}}$ in the expansion $(\sqrt{x}-3)^8$
21. The term containing x^{-7} in the expansion $(2x-x^{-3})^5$

22. The constant term in the expansion $(x + x^{-1})^8$
23. Use the Principle of Mathematical Induction to prove $n! > 2^n$ for $n \geq 4$.
24. Prove $\sum_{j=0}^n \binom{n}{j} = 2^n$ for all natural numbers n . (HINT: Use the Binomial Theorem!)
25. With the help of your classmates, research [Patterns and Properties of Pascal's Triangle](#).
26. You've just won three tickets to see the new film, '8.̄9.' Five of your friends, Albert, Beth, Chuck, Dan, and Eugene, are interested in seeing it with you. With the help of your classmates, list all the possible ways to distribute your two extra tickets among your five friends. Now suppose you've come down with the flu. List all the different ways you can distribute the three tickets among these five friends. How does this compare with the first list you made? What does this have to do with the fact that $\binom{5}{2} = \binom{5}{3}$?

Checkpoint Quiz 9.4

1. Use Pascal's Triangle to expand: $(x - 2y)^5$
2. Find the coefficient of x in the expansion: $\left(x + \frac{1}{x^2}\right)^{10}$

For worked out solutions to this quiz, click the links below:

- [Quiz Solution](#)

9.4.2 ANSWERS

1. 36

2. 720

3. 105

4. 1260

5. $n + 1$

6. $\frac{1}{k(k+1)(k+2)}$

7. 56

8. 1

9. $\frac{n(n-1)}{2}$

10. $(x + 2)^5 = x^5 + 10x^4 + 40x^3 + 80x^2 + 80x + 32$

11. $(2x - 1)^4 = 16x^4 - 32x^3 + 24x^2 - 8x + 1$

12. $\left(\frac{1}{3}x + y^2\right)^3 = \frac{1}{27}x^3 + \frac{1}{3}x^2y^2 + xy^4 + y^6$

13. $(x - x^{-1})^4 = x^4 - 4x^2 + 6 - 4x^{-2} + x^{-4}$

14. $-7 - 24i$

15. 8

16. i

17. -1

18. $80x^3y^2$

19. $236x^{117}$

20. $-24x^{\frac{7}{2}}$

21. $-40x^{-7}$

22. 70