

1. Simplify each of the following.

- a) -3^2 b) $(-3)^2$ c) $(3x)^2$ d) $\left(\frac{3}{4}\right)^3$
e) $2^n + 2^n$. (Hint: if you do not know in general, try $n = 1, 2, 3, 4, \dots$, and the idea will come!)

2. Completely factor each of the following.

- a) $7x^2 + 7x$ b) $7x^2 + 28$ c) $8x^3 - 50x$ d) $3x^4 - 3$

3. Determine, by completing the square whether the following quadratic expressions factor or not.

- a) $5x^2 - 40x + 125$ b) $5x^2 - 40x + 50$ c) $-12x - 2x^2 - 16$ d) $-12x - 2x^2 - 20$

4. Define a new operation, \odot as follows. For every $a, b \in \mathbb{N}$,

$$a \odot b = ab + a - 3b$$

- a) Compute the value of $5 \odot 2$.
b) Is the operation \odot commutative? Justify your answer.
c) Is the set \mathbb{N} closed under \odot ? Justify your answer.

5. A TV went on a 14% sale. The sale price is \$412.8. Find the original price of the TV.

6. Overnight, the number of bacteria increased by one hundred sixty percent. There are now 650000 bacteria. How many was there yesterday?

7. A stock loses 60% of its value. What must the percent of increase be to recover all of its lost value? (Hint: if no value for the stock is given, make up a few different numbers.)

8. Susan has a new job to distribute flyers. Every day she earns \$ 10 and an additional 5 cents per flyers distributed.

- a) Express Susan's daily income as a function f of n , where n is the number of flyers she distributes a day.
b) How much money does she make a day if she distributes 500 flyers?
c) How many flyers does she need to distribute a day in order to make \$50?

9. Find an equation for each of the following polynomial equations.

- a) $f(x)$ is a linear function, with $f(-3) = 13$ and $f(7) = -7$.
b) $f(x)$ is a quadratic function, with $f(-4) = 31$, $f(-1) = 10$, and $f(2) = 7$.
c) $f(x)$ is a cubic function, with $f(-1) = -7$, $f(0) = -1$, $f(2) = 17$, and $f(3) = 41$

10. Find the coordinates of all points where the graphs of $y = x^2 - 2x - 8$ and $y = 4x - 1$ intersect each other.

11. Consider the equation $y = mx + 2m + 5$

- a) Graph the equation if $m = 0$.
b) Graph the equation if $m = 1$.
c) Graph the equation if $m = -2$
d) If you solved the previous part correctly, all these lines pass through the same point. Which one?
e) Prove that for all values of m , the line $y = mx + 2m + 5$ will pass through the same point.

12. Consider the equation $y = 4mx - 21m + mx^2 + 4$.
- Find all values of m for which the graph $y = 4mx - 21m + mx^2 + 4$ is NOT a parabola.
 - Substitute a few values into m and graph the equations. No matter what values we use for m , the graphs will all pass through two fixed points. Find the coordinates of these points.
 - Prove that for all values of m , the graph passes through the points you found in part b).
13. Suppose that a is a number such that $\frac{1}{a^7} + a^7 = 5$. Find the exact value of $\frac{1}{a^{14}} + a^{14}$. (Hint: you do not need to find the value of a .)