



The following problems were created by the University of Waterloo's Centre for Education in Mathematics and Computing (CEMC). Visit [cemc.uwaterloo.ca](http://cemc.uwaterloo.ca) for more information and resources.

- 1) The expression  $6a - 5a + 4a - 3a + 2a - a$  is equal to  
 (A)  $3a$             (B)  $3a^6$             (C)  $3$             (D)  $-21a$             (E)  $-21a^6$
- 2) The expression  $a + 1 + a - 2 + a + 3 + a - 4$  is equal to  
 (A)  $10a$             (B)  $0$             (C)  $4a - 2$             (D)  $4a + 2$             (E)  $-2a$
- 3) If  $x = 2$ , then  $(x + 2 - x)(2 - x - 2)$  equals  
 (A)  $-12$             (B)  $4$             (C)  $0$             (D)  $12$             (E)  $-4$
- 4) In the addition shown, each of  $P$ ,  $Q$  and  $R$  is a digit.

$$\begin{array}{r} PQR \\ + \quad QR \\ \hline 1012 \end{array}$$

The value of  $P + Q + R$  is

- (A) 12            (B) 15            (C) 13            (D) 22            (E) 20
- 5) The list  $p, q, r, s$  consists of four consecutive integers listed in increasing order. If  $p + s = 109$ , the value of  $q + r$  is  
 (A) 108            (B) 109            (C) 110            (D) 117            (E) 111
  - 6) In the addition shown, each of  $X$ ,  $Y$  and  $Z$  represents a digit. What is the value of  $X + Y + Z$ ?  
 (A) 10            (B) 15            (C) 22  
 (D) 20            (E) 8

$$\begin{array}{r} X \ Y \ Z \\ X \ Y \ Z \\ + \quad \quad Y \ Z \\ \hline 1 \ 6 \ 7 \ 5 \end{array}$$

- 7) In the addition problem shown,  $m$ ,  $n$ ,  $p$ , and  $q$  represent positive digits. When the problem is completed correctly, the value of  $m + n + p + q$  is  
 (A) 23            (B) 24            (C) 21  
 (D) 22            (E) 20

$$\begin{array}{r} n \ 6 \ 3 \\ 7 \ p \ 2 \\ + \quad 5 \ 8 \ q \\ \hline m \ 0 \ 4 \ 2 \end{array}$$

## **ANSWERS AND SOURCES**

- 1) A, 2005 Pascal (Grade 9), #2
- 2) C, 2005 Cayley (Grade 10), #1
- 3) E, 2014 Fermat (Grade 11), #3
- 4) E, 2020 Gauss (Grade 8), #12
- 5) B, 2019 Pascal (Grade 9), #13
- 6) B, 2017 Cayley (Grade 10), #13
- 7) B, 2019 Cayley (Grade 10), #13