A2.N.7: Imaginary Numbers 1: Simplify powers of i

1 Mrs. Donahue made up a game to help her class learn about imaginary numbers. The winner will be the student whose expression is equivalent to $-i$. Which expression will win the game?
1) i^{46}
2) i^{47}
3) i^{48}
4) i^{49}

2 For any power of i, the imaginary unit, where b is a whole number, i^{4b+3} equals
1) 1
2) i
3) -1
4) $-i$

3 The expression i^{25} is equivalent to
1) 1
2) -1
3) i
4) $-i$

4 Which expression is equivalent to i^{55}?
1) 1
2) -1
3) i
4) $-i$

5 The value of i^{16} is
1) 1
2) -1
3) i
4) $-i$

6 The expression i^{10} is equivalent to
1) 1
2) i
3) -1
4) $-i$

7 When simplified, i^{99} is equivalent to
1) 1
2) -1
3) i
4) $-i$

8 Which expression is equivalent to i^{233}
1) 1
2) -1
3) i
4) $-i$

9 Which expression is equivalent to i^{37}
1) 1
2) -1
3) i
4) $-i$

10 The expression $2i^2 + 3i^3$ is equivalent to
1) $-2 - 3i$
2) $2 - 3i$
3) $-2 + 3i$
4) $2 + 3i$

11 When simplified, $i^{27} + i^{34}$ is equal to
1) i
2) i^{61}
3) $-i - 1$
4) $i - 1$

12 The expression $i^{100} + i^{101} + i^{102}$ equals
1) 1
2) -1
3) $-i$
4) i

13 If i is the imaginary unit, the expression $i^8 + i^9 + i^{10} + i^{11}$ is equivalent to
1) 1
2) -1
3) i
4) 0

14 Expressed in simplest form, $i^{16} + i^6 - 2i^5 + i^{13}$ is equivalent to
1) 1
2) -1
3) i
4) $-i$

15 What is the value of $i^{99} - i^3$?
1) 1
2) i^{96}
3) $-i$
4) 0

16 The product $i^3 \cdot i^7$ is
1) 1
2) -1
3) i
4) $-i$

17 The product of i^7 and i^5 is equivalent to
1) 1
2) -1
3) i
4) $-i$

18 The expression $i^0 \cdot i^1 \cdot i^2 \cdot i^3 \cdot i^4$ is equal to
1) 1
2) -1
3) i
4) $-i$

19 The expression $\frac{i^{16}}{i^3}$ is equivalent to
1) 1
2) -1
3) i
4) $-i$

20 The expression $i^2(2 - i)$ is equivalent to
1) $-2 - i$
2) $-2 + i$
3) $2 - i$
4) $2 + i$

21 The expression $3i(2i^2 - 5i)$ is equivalent to
1) $15 - 6i$
2) $15 - 5i$
3) $-15 - 5i$
4) $-1 + 0i$

22 What is the value of $(5i^3)^3$?
1) $-125i$
2) $125i$
3) $-15i$
4) $15i$

23 If $f(x) = x^2$, what is the value of $f(i^3)$?
1) 1
2) -1
3) i
4) $-i$

24 If $f(x) = x^2$, what is the value of $f(2i)$?
1) -2
2) 2
3) -4
4) 4

25 If $f(x) = x^3 - 2x^2$, then $f(i)$ is equivalent to
1) $-2 + i$
2) $-2 - i$
3) $2 + i$
4) $2 - i$

26 The expression $x(3i^2)^3 + 2xi^{12}$ is equivalent to
1) $2x + 27xi$
2) $-7x$
3) $-25x$
4) $-29x$

27 Express $xi^8 - yi^6$ in simplest form.

28 Express $4xi + 5yi^8 + 6xi^3 + 2yi^4$ in simplest $a + bi$ form.

29 Determine the value of n in simplest form:
$i^{13} + i^{18} + i^{31} + n = 0$

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Answer Section

1 ANS: 2 REF: 060615b
2 ANS: 4 REF: 061615a2
3 ANS: 3 REF: 010705b
4 ANS: 4 REF: 010905b
5 ANS: 1 REF: 018631siii
6 ANS: 3 REF: 069527siii
7 ANS: 4 REF: 089830siii
8 ANS: 3 REF: 010334siii
9 ANS: 3 REF: 080327siii
10 ANS: 1

$2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i$

REF: 081004a2
11 ANS: 3 REF: 080407b
12 ANS: 4 REF: 060819b
13 ANS: 4 REF: 060331siii
14 ANS: 4 REF: 080215b
15 ANS: 4 REF: 060315b
16 ANS: 2 REF: 088423siii
17 ANS: 1 REF: 061019a2
18 ANS: 2 REF: 060410b
19 ANS: 3 REF: 010518b
20 ANS: 2 REF: 069925siii
21 ANS: 1 REF: 080702b
22 ANS: 2 REF: 060224siii
23 ANS: 2 REF: 010034siii
24 ANS: 3 REF: 080128siii
25 ANS: 4 REF: 010415b
26 ANS: 3

$x(27i^6) + x(2i^{12}) = -27x + 2x = -25x$

REF: 011620a2
27 ANS:

$xi^8 - yi^6 = x(1) - y(-1) = x + y$

REF: 061533a2
28 ANS:

$4xi + 5yi^8 + 6xi^3 + 2yi^4 = 4xi + 5y - 6xi + 2y = 7y - 2xi$

REF: 011433a2

29 ANS:

$$i^{13} + i^{18} + i^{31} + n = 0$$
$$i + (-1) - i + n = 0$$
$$-1 + n = 0$$
$$n = 1$$

REF: 061228a2