

MATHEMATICS

Stage 4

Number and Algebra

Indices

Teacher: Chi Binh Le

Exam Equivalent Time: 165 minutes (based on allocation ~1.25 min/mark)

Questions

1. **E** Indices (247481)

What is the value of 25^2 ?

- A. 5
- B. 27
- C. 50
- D. 625

2. **E** Indices (247263)

Another way of writing 5^2 is

- A. 5×2
- B. 5×5
- C. $5 + 5$
- D. $2 \times 2 \times 2 \times 2 \times 2$

3. **E** Indices (247267)

Another way of writing 2^4 is

- A. 2×4
- B. 4×4
- C. $2 + 2 + 2 + 2$
- D. $2 \times 2 \times 2 \times 2$

4. **E** Indices (247270)

Another way of writing 4^3 is

- A. $3 + 3 + 3 + 3$
- B. 4×3
- C. $4 \times 4 \times 4$
- D. $4 + 4 + 4$

5. **D** Indices (247577)

Which of the following is equal to 32?

- A. $2^3 \times 2^2$
- B. $2^3 + 2^2$
- C. $3^2 + 2^2$
- D. $3^2 \times 2^2$

6. **C** Indices (247485)

Which one of these has the same value as 16^2 ?

- A. $32^2 \div 4$
- B. $2 \times 2 \times 4 \times 2 \times 4$
- C. 2×8^2
- D. $2 \times 16 \times 16$

7. **C** Indices (247593)

30^2 is equal to which of the following?

- A. $60^2 \div 3$
- B. $3^2 \times 2 \times 5 \times 2 \times 5$
- C. 9×5^2
- D. $3 \times 10 \times 10$

8. **C** Indices (247606)

7×2^3 is equal to which of the following?

- A. 28
- B. 42
- C. 56
- D. 2744

9. **C** Indices (247836)

$$2^5 - 2^3 = \square$$

Which number makes the expression above correct?

- A. 4
- B. 8
- C. 24
- D. 28

10. **C** Indices (248427)

Given that $12^2 = 144$, then $\sqrt{144} = ?$

- A. 288
- B. 72
- C. 12
- D. 6

11. **C** Indices (248443)

Between which two number does $\sqrt{30}$ lie?

- A. 3 and 4
- B. 4 and 5
- C. 5 and 6
- D. 6 and 7

12. **C** Indices (248449)

Between which two number does $\sqrt{70}$ lie?

- A. 5 and 6
- B. 6 and 7
- C. 7 and 8
- D. 8 and 9

13. **E** Indices (248255)

Evaluate $5^2 - 2^5$. (2 marks)

14. **E** Indices (248696)

Find the missing term in the following number sentence. (1 mark)

$$2^8 \times \square = 2^{14}$$

15. **E** Indices (248651)

a. Write $3^2 \times 3^4$ in expanded form. (1 mark)

b. Write your answer to (a) in index form. (1 mark)

16. **E** Indices (247274)

Write 6^4 in expanded form. (1 mark)

17. **E** Indices (247276)

Write $2^3 + 4^2$ in expanded form and evaluate. (2 marks)

18. **E** Indices (247280)

Write $3^3 \times 2^3$ in expanded form and evaluate. (2 marks)

19. **E** Indices (247283)

Write $7^1 \times 5^4 \times 4^3$ in expanded form. (2 marks)

20. **D** Indices (248180)

Write 10^7 in expanded form. (1 mark)

21. **D** Indices (247285)

Write $20^2 \times 32^1 \times 16^4$ in expanded form. (2 marks)

22. **D** Indices (248186)

Write 1 000 000 in:

a. Expanded form. (1 mark)

b. Index form. (1 mark)

23. **D** Indices (247879)

Write $3 \times 3 \times 3 \times 2 \times 2$ in index form. (2 marks)

24. **D** Indices (247881)

Write $4 \times 3 \times 4 \times 4 \times 3$ in index form. (2 marks)

25. **D** Indices (247891)

Write $7 \times 3 \times 5 \times 5 \times 7 \times 7 \times 5 \times 5 \times 5$ in index form. (2 marks)

26. **D** Indices (248660)

- a. Write $2^3 \times 2^2$ in expanded form. (1 mark)
 - b. Write your answer to (a) in index form. (1 mark)
-

27. **C** Indices (248662)

Simplify the following, giving your answers in index form.

- a. $5^3 \times 5^2$ (1 mark)
 - b. $7^7 \times 7$ (1 mark)
 - c. $6^4 \times 6^3$ (1 mark)
-

28. **C** Indices (248671)

Simplify the following, giving your answers in index form.

- a. $2^5 \times 2^4 \times 2$ (1 mark)
 - b. $4^3 \times 4^2 \times 4^6$ (1 mark)
 - c. $3^2 \times 3 \times 3^3$ (1 mark)
-

29. **C** Indices (248194)

Write 100 000 in:

- a. Expanded form. (1 mark)
 - b. Index form. (1 mark)
-

30. **C** Indices (248725)

Simplify the following, giving your answers in index form.

- a. $2^8 \div 2^4$ (1 mark)
 - b. $5^{15} \div 5^9$ (1 mark)
 - c. $3^4 \div 3$ (1 mark)
-

31. **C** Indices (248738)

Simplify the following, giving your answers in index form.

- a. $\frac{2^{16}}{2^9}$ (1 mark)
 - b. $\frac{4^8}{4^3}$ (1 mark)
 - c. $\frac{10^{11}}{10^2}$ (1 mark)
-

32. **C** Indices (248678)

Find the missing term in the following number sentence. (1 mark)

$4^3 \times \square = 4^8$

33. **C** Indices (248704)

Find the missing term in the following number sentence. (1 mark)

$\square \times 3^4 = 3^{11}$

34. **C** Indices (248708)

- a. Write $\frac{3^6}{3^4}$ as a fraction in expanded form. (2 marks)
 - b. Write your answer to (a) in simplified index form. (1 mark)
-

35. **C** Indices (248719)

- a. Write $\frac{7^5}{7^2}$ as a fraction in expanded form. (2 marks)
 - b. Write your answer to (a) in simplified index form. (1 mark)
-

36. **C** Indices (248750)

Find the missing term in the following number sentence. (1 mark)

$\square \div 3^4 = 3^7$

37. **C** Indices (248762)

Find the missing term in the following number sentence. (1 mark)

$\square \div 2^2 = 2^5$

38. **C** Indices (248765)

- a. Write $(2^3)^3$ in expanded form. (2 marks)
- b. Write your answer to (a) in simplified index form. (1 mark)

39. **C** Indices (248768)

- a. Write $(5^2)^4$ in expanded form. (2 marks)
- b. Write your answer to (a) in simplified index form. (1 mark)

40. **C** Indices (248770)

Simplify the following, giving your answers in index form.

- a. $(2^4)^4$ (1 mark)
- b. $(4^3)^5$ (1 mark)
- c. $(3^3)^3$ (1 mark)

41. **C** Indices (248774)

Simplify the following, giving your answers in index form.

- a. $(5^2)^2$ (1 mark)
- b. $(6^3)^4$ (1 mark)
- c. $(7^4)^5$ (1 mark)

42. **C** Indices (248176)

Express 16 as a power of 2. (1 mark)

43. **C** Indices (248243)

Write 625 in:

- a. Expanded form. (1 mark)
- b. Index form. (1 mark)

44. **C** Indices (248174)

Express 32 as a power of 2. (2 marks)

45. **C** Indices (248308)

Write 42 as a product of its prime factors. (2 marks)

46. **C** Indices (248310)

Write 110 as a product of its prime factors. (2 marks)

47. **C** Indices (248312)

Write 78 as a product of its prime factors. (2 marks)

48. **C** Indices (248134)

Insert the index power that makes this statement correct. (2 marks)

$$81 = 3^{\square}$$

49. **C** Indices (248157)

Insert the index powers that make this statement correct. (2 marks)

$$144 = 3^{\square} \times 2^{\square}$$

50. **C** Indices (248168)

Insert the index powers that make this statement correct. (2 marks)

$$108 = 3^{\square} \times 2^{\square}$$

51. **C** Indices (248248)

Evaluate $3^3 + 4^2$. (2 marks)

52. **C** Indices (248276)

Evaluate $(-1)^3$. (2 marks)

53. **C** Indices (248302)

Write 36 as a product of its prime factors in index form. (2 marks)

54. **C** Indices (248778)

Simplify the following, giving your answers in index form.

- a. $4^2 \div 4^2$ (1 mark)
- b. $6^3 \div 6^3$ (1 mark)
- c. $12^7 \div 12^7$ (1 mark)

55. **C** Indices (248788)

Simplify the following, giving your answers in index form.

a. 4^0 (1 mark)

b. $6^0 + 2^0$ (2 marks)

c. $4 + 2^0$ (2 marks)

56. **C** Indices (248791)

Simplify the following, giving your answers in index form.

a. $(2 + 3)^0$ (1 mark)

b. $2(4^0) - 2$ (2 marks)

c. $3 \times 6^0 + 4 \times 2^0$ (2 marks)

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Worked Solutions

1. **E** Indices (247481)

$$25^2 = 25 \times 25$$

$$= 625$$

$$\Rightarrow D$$

2. **E** Indices (247263)

$$5^2 = 5 \times 5$$

$$\Rightarrow B$$

3. **E** Indices (247267)

$$2^4 = 2 \times 2 \times 2 \times 2$$

$$\Rightarrow D$$

4. **E** Indices (247270)

$$4^3 = 4 \times 4 \times 4$$

$$\Rightarrow C$$

5. **D** Indices (247577)

$$2^3 \times 2^2 = 8 \times 4$$

$$= 32$$

$$\Rightarrow A$$

6. **C** Indices (247485)

$$16^2 = 16 \times 16$$

$$= 32 \div 2 \times 32 \div 2$$

$$= 32^2 \div 4$$

$$\Rightarrow A$$

7. **C** Indices (247593)

$$30^2 = 900$$

Checking Option B:

$$\begin{aligned} 3^2 \times 2 \times 5 \times 2 \times 5 \\ = 3^2 \times 10 \times 10 \\ = 900 \end{aligned}$$

$\Rightarrow B$

8. **C** Indices (247606)

$$\begin{aligned} 7 \times 2^3 &= 7 \times 2 \times 2 \times 2 \\ &= 7 \times 8 = 56 \end{aligned}$$

$\Rightarrow C$

9. **C** Indices (247836)

$$\begin{aligned} 2^5 - 2^3 &= 2 \times 2 \times 2 \times 2 \times 2 - 2 \times 2 \times 2 \\ &= 32 - 8 \\ &= 24 \end{aligned}$$

$\Rightarrow C$

10. **C** Indices (248427)

$$144 = 12 \times 12 \text{ (Given)}$$

$$\begin{aligned} \therefore \sqrt{144} &= \sqrt{12 \times 12} \\ &= 12 \end{aligned}$$

$\Rightarrow D$

11. **C** Indices (248443)

$$\begin{aligned} \text{Consider Option C: } \rightarrow \sqrt{25} &= 5 \\ \rightarrow \sqrt{36} &= 6 \end{aligned}$$

$\therefore \sqrt{30}$ lies between $\sqrt{25}$ and $\sqrt{36}$

$\therefore \sqrt{30}$ lies between 5 and 6

$\Rightarrow C$

12. **C** Indices (248449)

$$\begin{aligned} \text{Consider Option D: } \rightarrow \sqrt{64} &= 8 \\ \rightarrow \sqrt{81} &= 9 \end{aligned}$$

$\therefore \sqrt{70}$ lies between $\sqrt{64}$ and $\sqrt{81}$

$\therefore \sqrt{70}$ lies between 8 and 9

$\Rightarrow D$

13. **E** Indices (248255)

$$\begin{aligned} 5^2 - 2^5 &= (5 \times 5) - (2 \times 2 \times 2 \times 2 \times 2) \\ &= 25 - 32 \\ &= -7 \end{aligned}$$

14. **E** Indices (248696)

$$a^m \times a^n = a^{m+n}$$

$$2^8 \times 2^n = 2^{14}$$

$$\therefore 8 + n = 14$$

$$n = 6$$

$\therefore$ the missing term is 2^6

15. **E** Indices (248651)

$$\text{a. } 3^2 \times 3^4 = (3 \times 3) \times (3 \times 3 \times 3 \times 3)$$

$$\text{b. } 3^2 \times 3^4 = 3^6$$

16. **E** Indices (247274)

$$6^4 = 6 \times 6 \times 6 \times 6$$

17. **E** Indices (247276)

$$\begin{aligned} 2^3 + 4^2 &= 2 \times 2 \times 2 + 4 \times 4 \\ &= 8 + 16 = 24 \end{aligned}$$

18. **E** Indices (247280)

$$\begin{aligned} 3^3 \times 2^3 &= 3 \times 3 \times 3 \times 2 \times 2 \times 2 \\ &= 27 \times 8 = 216 \end{aligned}$$

19.

E

 Indices (247283)

$$7^1 \times 5^4 \times 4^3 = 7 \times 5 \times 5 \times 5 \times 5 \times 4 \times 4 \times 4$$

20.

D

 Indices (248180)

$$10^7 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$$

21.

D

 Indices (247285)

$$20^2 \times 32^1 \times 16^4 = 20 \times 20 \times 32 \times 16 \times 16 \times 16 \times 16$$

22.

D

 Indices (248186)

a. $1\,000\,000 = 10 \times 10 \times 10 \times 10 \times 10 \times 10$

b. $1\,000\,000 = 10^6$

23.

D

 Indices (247879)

$$3 \times 3 \times 3 \times 2 \times 2 = 3^3 \times 2^2$$

24.

D

 Indices (247881)

$$4 \times 3 \times 4 \times 4 \times 3 = 4^3 \times 3^2$$

25.

D

 Indices (247891)

$$7 \times 3 \times 5 \times 5 \times 7 \times 7 \times 5 \times 5 \times 5 = 7^3 \times 5^5 \times 3^1$$

26.

D

 Indices (248660)

a. $2^3 \times 2^2 = (2 \times 2 \times 2) \times (2 \times 2)$

b. $2^3 \times 2^2 = 2^5$

27.

C

 Indices (248662)

a. $5^3 \times 5^2 = 5^{3+2} = 5^5$

b. $7^7 \times 7^1 = 7^{7+1} = 7^8$

c. $6^4 \times 6^3 = 6^{4+3} = 6^7$

28.

C

 Indices (248671)

a. $2^5 \times 2^4 \times 2 = 2^{5+4+1} = 2^{10}$

b. $4^3 \times 4^2 \times 4^6 = 4^{3+2+6} = 4^{11}$

c. $3^2 \times 3^1 \times 3^3 = 3^{2+1+3} = 3^6$

29.

C

 Indices (248194)

a. $100\,000 = 10 \times 10 \times 10 \times 10 \times 10$

b. $100\,000 = 10^5$

30.

C

 Indices (248725)

a. $2^8 \div 2^4 = 2^{8-4} = 2^4$

b. $5^{15} \div 5^9 = 5^{15-9} = 5^6$

c. $3^4 \div 3^1 = 3^{4-1} = 3^3$

31.

C

 Indices (248738)

a. $\frac{2^{16}}{2^9} = 2^{16-9} = 2^7$

b. $\frac{4^8}{4^3} = 4^{8-3} = 4^5$

c. $\frac{10^{11}}{10^2} = 10^{11-2} = 10^9$

32.

C

 Indices (248678)

$$a^m \times a^n = a^{m+n}$$
$$4^3 \times 4^n = 4^8$$
$$\therefore 3 + n = 8$$
$$n = 5$$

$$\therefore \text{the missing term is } 4^5$$

33.

C

 Indices (248704)

$$a^m \times a^n = a^{m+n}$$
$$3^n \times 3^4 = 3^{11}$$
$$\therefore n + 4 = 11$$
$$n = 7$$

$$\therefore \text{the missing term is } 3^7$$

34. **C** Indices (248708)

a. $\frac{3^6}{3^4} = \frac{3 \times 3 \times 3 \times 3 \times 3 \times 3}{3 \times 3 \times 3 \times 3}$

b. $\frac{3 \times 3 \times 3 \times 3 \times 3 \times 3}{3 \times 3 \times 3 \times 3} = 3^2$

35. **C** Indices (248719)

a. $\frac{7^5}{7^2} = \frac{7 \times 7 \times 7 \times 7 \times 7}{7 \times 7}$

b. $\frac{7 \times 7 \times 7 \times 7 \times 7}{7 \times 7} = 7^3$

36. **C** Indices (248750)

$$a^m \div a^n = a^{m-n}$$

$$3^n \div 3^4 = 3^7$$

$$\therefore n - 4 = 7$$

$$n = 11$$

$\therefore$ the missing term is 3^{11}

37. **C** Indices (248762)

$$a^m \div a^n = a^{m-n}$$

$$2^n \div 2^2 = 2^5$$

$$\therefore n - 2 = 5$$

$$n = 7$$

$\therefore$ the missing term is 2^7

38. **C** Indices (248765)

a. $(2^3)^3 = (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2)$

b. $(2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) = 2^9$

39. **C** Indices (248768)

a. $(5^2)^4 = (5 \times 5) \times (5 \times 5) \times (5 \times 5) \times (5 \times 5)$

b. $(5 \times 5) \times (5 \times 5) \times (5 \times 5) \times (5 \times 5) = 5^8$

40. **C** Indices (248770)

a. $(2^4)^4 = 2^{4 \times 4} = 2^{16}$

b. $(4^3)^5 = 4^{3 \times 5} = 4^{15}$

c. $(3^3)^3 = 3^{3 \times 3} = 3^9$

41. **C** Indices (248774)

a. $(5^2)^2 = 5^{2 \times 2} = 5^4$

b. $(6^3)^4 = 6^{3 \times 4} = 6^{12}$

c. $(7^4)^5 = 7^{4 \times 5} = 7^{20}$

42. **C** Indices (248176)

$$16 = 4 \times 4$$

$$= (2 \times 2) \times (2 \times 2)$$

$$= 2^4$$

43. **C** Indices (248243)

a. $625 = 5 \times 125$

$$= 5 \times (5 \times 25)$$

$$= 5 \times 5 \times 5 \times 5$$

b. $625 = 5^4$

44. **C** Indices (248174)

$$32 = 2 \times 16$$

$$= 2 \times (4 \times 4)$$

$$= 2 \times (2 \times 2) \times (2 \times 2)$$

$$= 2^5$$

45. **C** Indices (248308)

$$42 = 6 \times 7$$

$$= 2 \times 3 \times 7$$

46. **C** Indices (248310)

$$110 = 10 \times 11$$

$$= 2 \times 5 \times 11$$

47. **C** Indices (248312)

$$\begin{aligned}78 &= 2 \times 39 \\ &= 2 \times 3 \times 13\end{aligned}$$

48. **C** Indices (248134)

$$\begin{aligned}81 &= 9 \times 9 \\ &= (3 \times 3) \times (3 \times 3) \\ &= 3^4\end{aligned}$$

$\therefore$ The correct power is 4

49. **C** Indices (248157)

$$\begin{aligned}144 &= 12 \times 12 \\ &= (4 \times 3) \times (4 \times 3) \\ &= (2 \times 2 \times 3) \times (2 \times 2 \times 3) \\ &= 3^2 \times 2^4 \\ \therefore \text{ The correct powers are 2 and 4.}\end{aligned}$$

50. **C** Indices (248168)

$$\begin{aligned}108 &= 12 \times 9 \\ &= (4 \times 3) \times (3 \times 3) \\ &= (2 \times 2 \times 3) \times (3 \times 3) \\ &= 3^3 \times 2^2 \\ \therefore \text{ The correct powers are 3 and 2.}\end{aligned}$$

51. **C** Indices (248248)

$$\begin{aligned}3^3 + 4^2 &= (3 \times 3 \times 3) + (4 \times 4) \\ &= 27 + 16 \\ &= 43\end{aligned}$$

52. **C** Indices (248276)

$$\begin{aligned}(-1)^3 &= -1 \times -1 \times -1 \\ &= 1 \times -1 \\ &= -1\end{aligned}$$

53. **C** Indices (248302)

$$\begin{aligned}36 &= 6 \times 6 \\ &= 2 \times 3 \times 2 \times 3 \\ &= 2^2 \times 3^2\end{aligned}$$

54. **C** Indices (248778)

$$\begin{aligned}\text{a. } 4^2 \div 4^2 &= 4^{2-2} = 4^0 \\ \text{b. } 6^3 \div 6^3 &= 6^{3-3} = 6^0 \\ \text{c. } 12^7 \div 12^7 &= 12^{7-7} = 12^0\end{aligned}$$

55. **C** Indices (248788)

$$\begin{aligned}\text{a. } 4^0 &= 1 \\ \text{b. } 6^0 + 2^0 &= 1 + 1 = 2 \\ \text{c. } 4 + 2^0 &= 4 + 1 = 5\end{aligned}$$

56. **C** Indices (248791)

$$\begin{aligned}\text{a. } (2 + 3)^0 &= 5^0 = 1 \\ \text{b. } 2(4^0) - 2 &= 2 \times 1 - 2 = 0 \\ \text{c. } 3 \times 6^0 + 4 \times 2^0 &= 3 \times 1 + 4 \times 1 = 7\end{aligned}$$

MATHEMATICS

Stage 4

Number and Algebra

Indices

Teacher: Chi Binh Le

Exam Equivalent Time: 144 minutes (based on allocation ~1.25 min/mark)

Questions

1. **B** Indices (248337)

Which of the following numbers is **not** divisible by 2?

- A. 505
- B. 44
- C. 1258
- D. 1202

2. **B** Indices (248344)

Which of the following numbers is **not** divisible by 5?

- A. 1800
- B. 95
- C. 102
- D. 1 202 005

3. **B** Indices (247851)

Which expression is equal to $6^3 \times 36^2$?

- A. $6 \times 3 \times 36 \times 2$
- B. $6 \times 6 \times 6 \times 6 \times 6$
- C. $6 \times 6 \times 6 \times 36 \times 6$
- D. $6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6$

4. **B** Indices (248348)

Which of the following numbers is **not** divisible by 9?

- A. 234
- B. 1845
- C. 506
- D. 126

5. **B** Indices (248318)

Which of the following numbers is **not** divisible by 3?

- A. 3102
- B. 239
- C. 42
- D. 8121

6. **B** Indices (248327)

Which of the following numbers is **not** divisible by 4?

- A. 112
- B. 32
- C. 502
- D. 608

7. **B** Indices (248424)

Given that $17^2 = 289$, then $\sqrt{289} = ?$

- A. 8.5
- B. 13.5
- C. 17
- D. 578

8. **B** Indices (248422)

Given that $21^2 = 441$, then $\sqrt{441} = ?$

- A. 21
- B. 42
- C. 420
- D. 194 481

9. **B+** Indices (248420)

Given that $4^3 = 64$, then $\sqrt[3]{64} = ?$

- A. 2
- B. 4
- C. 8
- D. 21.3

10. **B+** Indices (248416)

Given that $8^3 = 512$, then $\sqrt[3]{512} = ?$

- A. 8
- B. 23
- C. 128
- D. 171

11. **B+** Indices (248408)

Given that $5^3 = 125$, then $\sqrt[3]{125} = ?$

- A. 62.5
- B. 41.7
- C. 11.2
- D. 5

12. **B** Indices (248304)

Write **56** as a product of its prime factors in index form. (2 marks)

13. **B** Indices (248306)

Write **99** as a product of its prime factors in index form. (2 marks)

14. **B** Indices (248314)

Write **324** as a product of its prime factors in index form. (2 marks)

15. **B** Indices (248279)

Evaluate $(-2)^4$. (2 marks)

16. **B** Indices (247877)

Write $27^2 \times 2^3$ in expanded form. (2 marks)

17. **B** Indices (247870)

Write $3^3 \times 49^2$ in expanded form. (2 marks)

18. **B** Indices (248258)

Evaluate $2^3 + 4 \times 3^2$. (2 marks)

19. **B** Indices (248796)

Simplify $4(2^2)^2$, giving your answer in simplified index form. (2 marks)

20. **B** Indices (248281)

Evaluate $(-1)^4 - (-2)^3$. (2 marks)

21. **B** Indices (248803)

Simplify $\frac{3^6 \times 3^2}{3^3}$, giving your answer in simplified index form. (2 marks)

22. **B** Indices (248806)

Simplify $3m^0 + (4m)^0 - (7m^4)^0$, giving your answer in simplified index form. (2 marks)

23. **B** Indices (248800)

Simplify $2^3 \times 5^4 \times 2^5 \div 5^2$, giving your answer in simplified index form. (2 marks)

24. **B+** Indices (248274)

Evaluate $2^2 \times 7 - 5 \times 4^3$. (2 marks)

25. **B+** Indices (248271)

Evaluate $5^2 - 3 \times 2^3$. (2 marks)

26. **B+** Indices (248353)

Prove using divisibility tests that **282** is divisible by **6**. (2 marks)

27. **B+** Indices (248474)

Evaluate $\sqrt[3]{27} - \sqrt{25}$. (2 marks)

28. B+ Indices (248478)

Evaluate $3 \times \sqrt{81} + \sqrt[3]{27} \times 2$. (2 marks)

29. B+ Indices (248476)

Evaluate $3 \times \sqrt[3]{64} - \sqrt{100}$. (2 marks)

30. B+ Indices (248469)

Evaluate $\sqrt{9} + \sqrt[3]{8}$. (2 marks)

31. A Indices (248429)

Show that $\sqrt{144} = \sqrt{36} \times \sqrt{4}$. (2 marks)

32. A Indices (248439)

Show that $\sqrt{25 \times 16} = \sqrt{25} \times \sqrt{16}$. (2 marks)

33. A Indices (248441)

Show that $\sqrt{9 \times 4} = \sqrt{9} \times \sqrt{4}$. (2 marks)

34. A Indices (248437)

Show that $\sqrt{225} = \sqrt{25} \times \sqrt{9}$. (2 marks)

35. A Indices (248383)

- a. Write **8** as a product of its prime factors. (2 marks)
- b. Hence find $\sqrt[3]{8}$. (1 mark)

36. A Indices (248365)

Using divisibility tests, find the smallest number greater than **1000** that is divisible by **6**. (2 marks)

37. A Indices (248358)

A number is divisible by **12** if it is also divisible by **3** and **4**.
Prove, using the divisibility tests for 3 and 4, that **756** is divisible by **12**. (2 marks)

38. A Indices (248374)

Using divisibility tests, find the smallest number greater than **200** that is divisible by **6**. (2 marks)

39. A Indices (248380)

Using divisibility tests, find the largest number less than **500** that is divisible by **9**. (2 marks)

40. A Indices (248395)

- a. Write **256** as a product of its prime factors. (2 marks)
- b. Hence find $\sqrt{256}$. (2 marks)

41. A+ Indices (248398)

- a. Write **324** as a product of its prime factors. (2 marks)
- b. Hence find $\sqrt{324}$. (2 marks)

42. A+ Indices (248403)

- a. Write **1024** as a product of its prime factors. (2 marks)
- b. Hence find $\sqrt{1024}$. (2 marks)

43. A+ Indices (248393)

- a. Write **216** as a product of its prime factors. (2 marks)
- b. Hence find $\sqrt[3]{216}$. (2 marks)

44. A+ Indices (248406)

- a. Write **900** as a product of its prime factors. (2 marks)
- b. Hence find $\sqrt{900}$. (2 marks)

45. A+ Indices (248285)

- a. Explain why a negative number raised to an even power will always have a positive answer. (2 marks)
- b. Give 2 worked examples that verify your explanation. (2 marks)

46. A+ Indices (248294)

- a. Explain why a negative number raised to an odd power will always have a negative answer. (2 marks)
- b. Give 2 worked examples that verify your explanation. (2 marks)

47. A+ Indices (248454)

Find the missing whole number that makes the following number sentence correct. (2 marks)

$3 \times \square^2 + (\sqrt{25} - \square) = \sqrt{\square} \times 9 \times 3 - 5$

Worked Solutions

- 1.
- B**
- Indices (248337)

A number is divisible by 2 if the last digit is a 2, 4, 6, 8 or 0.**Option A:** → 505 does not end in 2, 4, 6, 8 or 0. $\Rightarrow A$

- 2.
- B**
- Indices (248344)

A number is divisible by 5 if the last digit is a 5 or 0.**Option C:** → 102 does not end in 5 or 0. $\Rightarrow C$

- 3.
- B**
- Indices (247851)

$$\begin{aligned}
 6^3 \times 36^2 &= (6 \times 6 \times 6) \times (6 \times 6)^2 \\
 &= (6 \times 6 \times 6) \times (6 \times 6) \times (6 \times 6) \\
 &= 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6
 \end{aligned}$$

 $\Rightarrow D$

- 4.
- B**
- Indices (248348)

A number is divisible by 9 if the sum of the digits is divisible by 9.**Option A:** → $2 + 3 + 4 = 9$ ✓**Option B:** → $1 + 8 + 4 + 5 = 18$ ✓**Option C:** → $5 + 0 + 6 = 11$ – not divisible by 9**Option D:** → $1 + 2 + 6 = 9$ ✓ $\Rightarrow C$

- 5.
- B**
- Indices (248318)

A number is divisible by 3 if the sum of its digits are divisible by 3.**Option A:** → $3 + 1 + 0 + 2 = 6$ ✓**Option B:** → $2 + 3 + 9 = 14$ not divisible by 3**Option C:** → $4 + 2 = 6$ ✓**Option D:** → $8 + 1 + 2 + 1 = 12$ ✓ $\Rightarrow B$

6. **B** Indices (248327)

A number is divisible by 4 if the last 2 digits are divisible by 4.

Option A: $\rightarrow 12 \div 4 = 3$ ✓

Option B: $\rightarrow 32 \div 4 = 8$ ✓

Option C: $\rightarrow 02$ not divisible by 4

Option D: $\rightarrow 8 \div 4 = 2$ ✓

$\Rightarrow C$

7. **B** Indices (248424)

$289 = 17 \times 17$ (Given)

$$\therefore \sqrt{289} = \sqrt{17 \times 17} \\ = 17$$

$\Rightarrow C$

8. **B** Indices (248422)

$441 = 21 \times 21$ (Given)

$$\therefore \sqrt{441} = \sqrt{21 \times 21} \\ = 21$$

$\Rightarrow A$

9. **B+** Indices (248420)

$64 = 4 \times 4 \times 4$ (Given)

$$\therefore \sqrt[3]{64} = \sqrt[3]{4 \times 4 \times 4} \\ = 4$$

$\Rightarrow B$

10. **B+** Indices (248416)

$512 = 8 \times 8 \times 8$ (Given)

$$\therefore \sqrt[3]{512} = \sqrt[3]{8 \times 8 \times 8} \\ = 8$$

$\Rightarrow A$

11. **B+** Indices (248408)

$125 = 5 \times 5 \times 5$ (Given)

$$\therefore \sqrt[3]{125} = \sqrt[3]{5 \times 5 \times 5} \\ = 5$$

$\Rightarrow D$

12. **B** Indices (248304)

$$56 = 7 \times 8 \\ = 7 \times 2 \times 2 \times 2 \\ = 7 \times 2^3$$

13. **B** Indices (248306)

$$99 = 11 \times 9 \\ = 11 \times 3 \times 3 \\ = 11 \times 3^2$$

14. **B** Indices (248314)

$$324 = 4 \times 81 \\ = 2 \times 2 \times 9 \times 9 \\ = 2 \times 2 \times 3 \times 3 \times 3 \times 3 \\ = 2^2 \times 3^4$$

15. **B** Indices (248279)

$$(-2)^4 = (-2 \times -2) \times (-2 \times -2) \\ = 4 \times 4 \\ = 16$$

16. **B** Indices (247877)

$$27^2 \times 2^3 = (27 \times 27) \times (2 \times 2 \times 2) \\ = (3 \times 3 \times 3) \times (3 \times 3 \times 3) \times (2 \times 2 \times 2) \\ = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 2 \times 2 \times 2$$

17. **B** Indices (247870)

$$\begin{aligned} 3^3 \times 49^2 &= (3 \times 3 \times 3) \times (7 \times 7)^2 \\ &= (3 \times 3 \times 3) \times (7 \times 7) \times (7 \times 7) \\ &= 3 \times 3 \times 3 \times 7 \times 7 \times 7 \times 7 \end{aligned}$$

18. **B** Indices (248258)

$$\begin{aligned} 2^3 + 4 \times 3^2 &= (2 \times 2 \times 2) + 4 \times (3 \times 3) \\ &= 8 + 4 \times 9 \\ &= 8 + 36 = 44 \end{aligned}$$

19. **B** Indices (248796)

$$\begin{aligned} 4(2^2)^2 &= 4 \times 2^4 \\ &= 4 \times 16 \\ &= 64 \end{aligned}$$

20. **B** Indices (248281)

$$\begin{aligned} (-1)^4 - (-2)^3 &= [(-1 \times -1) \times (-1 \times -1)] - [(-2 \times -2) \times -2] \\ &= (1 \times 1) - (4 \times -2) \\ &= 1 - -8 = 9 \end{aligned}$$

21. **B** Indices (248803)

$$\begin{aligned} \frac{3^6 \times 3^2}{3^3} &= \frac{3^8}{3^3} \\ &= 3^5 \end{aligned}$$

22. **B** Indices (248806)

$$\begin{aligned} 3m^0 + (4m)^0 - (7m^4)^0 &= 3 \times 1 + 1 - 1 \\ &= 3 \end{aligned}$$

23. **B** Indices (248800)

$$\begin{aligned} 2^3 \times 5^4 \times 2^5 \div 5^2 &= 2^{3+5} \times 5^{4-2} \\ &= 2^8 \times 5^2 \end{aligned}$$

24. **B+** Indices (248274)

$$\begin{aligned} 2^2 \times 7 - 5 \times 4^3 &= (2 \times 2) \times 7 - 5 \times (4 \times 4 \times 4) \\ &= 4 \times 7 - 5 \times 64 \\ &= 28 - 320 = -292 \end{aligned}$$

25. **B+** Indices (248271)

$$\begin{aligned} 5^2 - 3 \times 2^3 &= (5 \times 5) - 3 \times (2 \times 2 \times 2) \\ &= 25 - 3 \times 8 \\ &= 25 - 24 = 1 \end{aligned}$$

26. **B+** Indices (248353)

A number is divisible by 6 if it is divisible by both 2 and 3.
For divisibility by 2 the number must end in 2, 4, 6, 8, 0. ✓
For divisibility by 3 the sum of the digits must be divisible by 3.
 $2 + 8 + 2 = 12 \Rightarrow$ divisible by 3 ✓
 $\therefore$ 282 is divisible by 6

27. **B+** Indices (248474)

$$\begin{aligned} \sqrt[3]{27} - \sqrt{25} &= \sqrt[3]{3 \times 3 \times 3} - \sqrt{5 \times 5} \\ &= 3 - 5 \\ &= -2 \end{aligned}$$

28. **B+** Indices (248478)

$$\begin{aligned} 3 \times \sqrt{81} + \sqrt[3]{27} \times 2 &= 3 \times \sqrt{9 \times 9} + \sqrt[3]{3 \times 3 \times 3} \times 2 \\ &= 3 \times 9 + 3 \times 2 \\ &= 33 \end{aligned}$$

29. **B+** Indices (248476)

$$\begin{aligned} 3 \times \sqrt[3]{64} - \sqrt{100} &= 3 \times \sqrt[3]{4 \times 4 \times 4} - \sqrt{10 \times 10} \\ &= 3 \times 4 - 10 \\ &= 2 \end{aligned}$$

30. **B+** Indices (248469)

$$\begin{aligned}\sqrt{9} + \sqrt[3]{8} &= \sqrt{3 \times 3} + \sqrt[3]{2 \times 2 \times 2} \\ &= 3 + 2 \\ &= 5\end{aligned}$$

31. **A** Indices (248429)

$$\begin{aligned}\text{LHS: } \sqrt{144} &= \sqrt{12 \times 12} \\ &= 12\end{aligned}$$

$$\begin{aligned}\text{RHS: } \sqrt{36} \times \sqrt{4} &= 6 \times 2 \\ &= 12 \\ \therefore \text{LHS} &= \text{RHS} \\ \therefore \sqrt{144} &= \sqrt{36} \times \sqrt{4}\end{aligned}$$

32. **A** Indices (248439)

$$\begin{aligned}\text{LHS: } \sqrt{25 \times 16} &= \sqrt{5 \times 5 \times 4 \times 4} \\ &= \sqrt{20 \times 20} \\ &= 20\end{aligned}$$

$$\begin{aligned}\text{RHS: } \sqrt{25} \times \sqrt{16} &= 5 \times 4 \\ &= 20 \\ \therefore \text{LHS} &= \text{RHS} \\ \therefore \sqrt{25 \times 16} &= \sqrt{25} \times \sqrt{16}\end{aligned}$$

33. **A** Indices (248441)

$$\begin{aligned}\text{LHS: } \sqrt{9 \times 4} &= \sqrt{3 \times 3 \times 2 \times 2} \\ &= \sqrt{6 \times 6} \\ &= 6\end{aligned}$$

$$\begin{aligned}\text{RHS: } \sqrt{9} \times \sqrt{4} &= 3 \times 2 \\ &= 6 \\ \therefore \text{LHS} &= \text{RHS} \\ \therefore \sqrt{9 \times 4} &= \sqrt{9} \times \sqrt{4}\end{aligned}$$

34. **A** Indices (248437)

$$\begin{aligned}\text{LHS: } \sqrt{225} &= \sqrt{5 \times 45} \\ &= \sqrt{5 \times 5 \times 9} \\ &= \sqrt{5 \times 5 \times 3 \times 3} \\ &= \sqrt{15 \times 15} \\ &= 15\end{aligned}$$

$$\begin{aligned}\text{RHS: } \sqrt{25} \times \sqrt{9} &= 5 \times 3 \\ &= 15\end{aligned}$$

$$\therefore \text{LHS} = \text{RHS}$$

$$\therefore \sqrt{225} = \sqrt{25} \times \sqrt{9}$$

35. **A** Indices (248383)

$$\begin{aligned}\text{a. } 8 &= 2 \times 4 \\ &= 2 \times 2 \times 2\end{aligned}$$

$$\begin{aligned}\text{b. } \sqrt[3]{8} &= \sqrt[3]{2 \times 2 \times 2} \\ &= 2\end{aligned}$$

36. **A** Indices (248365)

A number is divisible by 6 if it is divisible by both 2 and 3.

A number is divisible by 2 if the last digit is 2, 4, 6, 8, 0.

$\therefore$ The first possible number is 1002 as it is divisible by 2

A number is divisible by 3 if the sum of the digits is divisible by 3.

$$1 + 0 + 0 + 2 = 3 \Rightarrow \text{divisible by 3 } \checkmark$$

$\therefore$ 1002 is the smallest number greater than 1000 that is divisible by 6.

37. **A** Indices (248358)

A number is divisible by 3 if the sum of the digits is divisible by 3.

$$7 + 5 + 6 = 18 \Rightarrow \text{divisible by 3 } \checkmark$$

For divisibility by 4 the last 2 digits in the number must be divisible by 4.

$$56 \div 4 = 14 \Rightarrow \text{divisible by 4 } \checkmark$$

$\therefore$ 756 is divisible by 12 as it is divisible by both 3 and 4.

38. **A** Indices (248374)

A number is divisible by 6 if it is divisible by both 2 and 3.

A number is divisible by 2 if the last digit is 2, 4, 6, 8, 0.

∴ The possible numbers are in the pattern 202, 204, 206... as they are all divisible by 2

A number is divisible by 3 if the sum of the digits is divisible by 3.

$$2 + 0 + 2 = 4 \Rightarrow \text{not divisible by 3}$$

$$2 + 0 + 4 = 6 \Rightarrow \text{divisible by 3} \checkmark$$

∴ 204 is the smallest number greater than 200 that is divisible by 6.

39. **A** Indices (248380)

A number is divisible by 9 if the sum of the digits is divisible by 9.

Checking numbers less than 500

$$499 = 4 + 9 + 9 = 22 \Rightarrow \text{not divisible by 9}$$

$$498 = 4 + 9 + 8 = 21 \Rightarrow \text{not divisible by 9}$$

$$497 = 4 + 9 + 7 = 20 \Rightarrow \text{not divisible by 9}$$

$$496 = 4 + 9 + 6 = 19 \Rightarrow \text{not divisible by 9}$$

$$495 = 4 + 9 + 5 = 18 \Rightarrow \text{divisible by 9} \checkmark$$

∴ 495 is the largest number less than 500 that is divisible by 9.

40. **A** Indices (248395)

a. $256 = 2 \times 128$

$$= 2 \times 2 \times 64$$

$$= 2 \times 2 \times 2 \times 32$$

$$= 2 \times 2 \times 2 \times 2 \times 16$$

$$= 2 \times 2 \times 2 \times 2 \times 2 \times 8$$

$$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 4$$

$$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

b. $\sqrt{216} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$

$$= \sqrt{(2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2)}$$

$$= \sqrt{16 \times 16}$$

$$= 16$$

41. **A+** Indices (248398)

a. $324 = 2 \times 162$

$$= 2 \times 2 \times 81$$

$$= 2 \times 2 \times 9 \times 9$$

$$= 2 \times 2 \times 3 \times 3 \times 3 \times 3$$

b. $\sqrt{324} = \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 3}$

$$= \sqrt{(2 \times 3 \times 3) \times (2 \times 3 \times 3)}$$

$$= \sqrt{18 \times 18}$$

$$= 18$$

42. **A+** Indices (248403)

a. $1024 = 2 \times 512$

$$= 2 \times 2 \times 256$$

$$= 2 \times 2 \times 2 \times 128$$

$$= 2 \times 2 \times 2 \times 2 \times 64$$

$$= 2 \times 2 \times 2 \times 2 \times 8 \times 8$$

$$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 4 \times 2 \times 4$$

$$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

b. $\sqrt{324} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$

$$= \sqrt{(2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2)}$$

$$= \sqrt{32 \times 32}$$

$$= 32$$

43. **A+** Indices (248393)

a. $216 = 2 \times 108$
 $= 2 \times 2 \times 54$
 $= 2 \times 2 \times 2 \times 27$
 $= 2 \times 2 \times 2 \times 3 \times 9$
 $= 2 \times 2 \times 2 \times 3 \times 3 \times 3$

b. $\sqrt[3]{216} = \sqrt[3]{2 \times 2 \times 2 \times 3 \times 3 \times 3}$
 $= \sqrt[3]{(2 \times 3) \times (2 \times 3) \times (2 \times 3)}$
 $= \sqrt[3]{6 \times 6 \times 6}$
 $= 6$

44. **A+** Indices (248406)

a. $900 = 9 \times 100$
 $= 3 \times 3 \times 10 \times 10$
 $= 3 \times 3 \times 2 \times 5 \times 2 \times 5$
 $= 2 \times 2 \times 3 \times 3 \times 5 \times 5$

b. $\sqrt{900} = \sqrt{2 \times 2 \times 3 \times 3 \times 5 \times 5}$
 $= \sqrt{(2 \times 3 \times 5) \times (2 \times 3 \times 5)}$
 $= \sqrt{30 \times 30}$
 $= 30$

45. **A+** Indices (248285)

- a. **A negative number multiplied by a negative number always has a positive answer.**
It therefore, follows that when a negative number is multiplied by a negative number, an even number of times, as is the case with even powers such as 2, 4, 6... , the answer is also always positive.
- b. **Examples (Others are also acceptable)**
 $(-1)^2 = -1 \times -1 = 1$
 $(-1)^4 = -1 \times -1 \times -1 \times -1 = 1$

46. **A+** Indices (248294)

- a. **A negative number multiplied by a negative number an odd number of times always has a negative answer.**
It therefore, follows that when a negative number is raised to an odd power, such as 1, 3, 5... , the answer is also always negative.
ie $(- \times -) \times - = + \times - = -$
- b. **Examples (Others are also acceptable)**
 $(-1)^3 = (-1 \times -1) \times -1 = 1 \times -1 = -1$
 $(-1)^5 = (-1 \times -1) \times (-1 \times -1) \times -1 = 1 \times 1 \times -1 = -1$

47. **A+** Indices (248454)

Using trial and error method:

Test 1st square number $\rightarrow 1$

LHS: $3 \times 1^2 + (\sqrt{25} - 1) = 3 \times 1 + (5 - 1)$
 $= 7$

RHS: $\sqrt{1} \times 9 \times 3 - 5 = 1 \times 27 - 5$
 $= 23$

LHS $\neq$ RHS

Test 2nd square number $\rightarrow 4$

LHS: $3 \times 4^2 + (\sqrt{25} - 4) = 3 \times 16 + (5 - 4)$
 $= 49$

RHS: $\sqrt{4} \times 9 \times 3 - 5 = 2 \times 27 - 5$
 $= 49$

LHS = RHS

$\therefore \square = 4$