N1 Numbers & their operations

Questions

[2014(Standard form).P1Q5]

(a) Express 0.000 085 2 in standard form. [1]

(b) Calculate $\left(3\times10^{5}\right)\div\left(6\times10^{-2}\right)$, giving your answer in standard form. [1]

ANS: (a) 8.52×10^{-5} (b) 5×10^{6}

[Teachers' Comments:] *(a) The correct answer was often seen. The incorrect* 8.52×10^{5} *was a common wrong answer. Some misunderstanding of standard form was apparent, with answers such as* 8.52×10^{-6} *seen, and answers containing 852. Some candidates dropped the digit 2 in the working as well as in the final answer. (b) There were some clearly set out calculations leading to the correct answer. A number of candidates left* 0.5×10^{7} *as their final answer. This was sometimes incorrectly adjusted to* 5×10^{-8}. *An answer of* 0.5×10^{3} *was also seen. Some candidates did not reach 0.5 or 5, giving answers such as* 2×10^{3} *and* 2×10^{6}. *Getting both the correct a and the correct n in the standard form* $a\times10^{n}$ *was clearly a challenge for many candidates.*

1. Express 42875 as a product of its prime factors. Hence, find $\sqrt[3]{42875}$.

2. The numbers 2450 and 1715, written as the products of prime factors, are

$$2450=5^{2}\times7^{2}\times p\ ,\ 1715=5\times7^{2}\times q$$

Use these result to find

(a) the value of p and q,

(b) the smallest positive integer k, such that $2450k$ is a perfect cube,

(c) the smallest positive integer w, such that $1715w$ is divisible by 2450

3. Express the following as a product of their prime factors:

(a) 972

(b) 3645

(c) 16200

4. Express 2772 as a product of its prime factors, leaving your answer in index from. Hence, find the smallest whole number by which 2772 must be multiplied in order to give a perfect square.

5. The number 168 and 324, written as the products of their prime factors, are

$$168=2^{3}\times3\times7\ ,\ \ 324=2^{2}\times3^{4}$$

Find

(a) $\sqrt{324}$

(b) the largest integer which is a factor of both 168 and 324

(c) the smallest positive integer value of n for which $168n$ is a multiple of 324

6. (a) Express 21, 60 and 70 as a product of their prime factors

(b) Find the smallest integer m such that $60m$ is a perfect square

7. Write 252 as a product of its prime factors. Hence,

(a) Find the least common multiple of 252 and 168

(b) Find the smallest integer m such that $252m$ is a perfect square

8. Expressed as the product of its prime factors,

$630 = 2 \times 3^2 \times 5 \times 7$ and $495 = 3^2 \times 5 \times 11$

Use these results to find

(a) the smallest integer, m such that $630m$ is a perfect square

(b) the smallest integer, k such that $495k$ is a multiple of 630

(c) the highest common factor of 630 and 495

9. Expressed as the product of its prime factors,

$756 = 2^2 \times 3^2 \times 7$

(a) Write 936 as the product of its prime factors

(b) Find the highest common factor of 756 and 936. Give your answer as the product of its prime factors.

(c) Find the smallest positive integer k such that $756k$ is a perfect square

10. Expressed as a product of prime factors

$168 = 2^3 \times 3 \times 7$ and $A = 2^p \times 3^3 \times 5$

Using the above information,

(a) The smallest integer k such that $168k$ is a perfect square

(b) The value of p and of A given that the highest common factor of 168 and A is 12

(c) The smallest positive integer n for which $A \times n$ is a multiple of 168

11. Given that

$540 = 2^2 \times 3^3 \times 5$ and $1050 = 2 \times 3 \times 5^2 \times 7$,

Find,

(a) The highest common factor of 540 and 1050,

(b) The smallest integer m such that $540m$ is a perfect square

12. Express 2744 as the product of its prime factors.

Hence evaluate $\sqrt[3]{2744}$

13. Express 72 as the product of its prime factors

Find the smallest integer value of k for which $72k$ is a multiple of 42.

14. Evaluate

(a) $16 - 3 \times (-9) + 12 \div 4$

(b) $3\frac{1}{7} \div 2\frac{1}{3}$

15. Find the value of

(a) $0.3 \times 0.56 - 2.18$

(b) $\sqrt{1.44} - \sqrt[3]{0.008}$

(c) $-9 + 42 \div \left(-\frac{3}{2}\right)$

16. Evaluate

(a) $-0.75 + (-2.1)(9.6 - 11.2)$

(b) $\dfrac{\left[\frac{2}{5} - \left(-\frac{1}{4}\right)\right] \div \left(-\frac{1}{20}\right)}{\left(-2\frac{2}{5}\right)\left(-1\frac{3}{4}\right)}$

17. Evaluate

(a) $\dfrac{0.4(0.2 - 0.6)}{0.25}$

(b) $\frac{1}{7} - 1\frac{3}{7} + 3\frac{3}{14}$ as a fraction in lowest terms

18. Giving your answer in the simplest form

(a) Evaluate $3\frac{1}{2} - 1\frac{3}{5}$

(b) Find the fraction that is exactly halfway between $\frac{7}{9}$ and $\frac{8}{9}$

19. Evaluate $\sqrt{\dfrac{3.6012}{0.4328 \times 25.03}}$, giving your answer correct to 3 significant figures.

20. Using as much information below as is necessary, find the value of $\sqrt[3]{0.004568}$.

$\left\{\sqrt[3]{4.568}, = 1.659 \sqrt[3]{45.68} = 3.575\right\}$

21. Using as much of the information below as is necessary, evaluate $\sqrt{35800}$.

$\left\{\sqrt{3.58}=1.892, \sqrt{35.8}=5.983\right\}$

22. Given that $\sqrt{11}=3.32$ and $\sqrt{1.1}=1.05$, evaluate the following, leaving your answers in standard form.

(a) $\sqrt{0.00000004}$

(b) $\sqrt{1760000}$

23. Find the smallest prime number x such that

$7x+5<13x-16$.

24. Write down the greatest and least integers which satisfy $-6<1-3x<2$.

25. List all the prime numbers, x which satisfy the following inequality

$$-5<\frac{7-2x}{2}<3$$

26. Given that $-6\le x\le 5$ and $-3\le y\le 4$, find

(a) the least possible value of $\frac{y}{x}$

(b) the greatest possible value of $\frac{x^2-y^2}{y-x}$

27. (a) Find the integer solutions of $-1<5-2x\le 7$

(b) Given that $-1<x<5,\quad 2<y<7$, find

(i) the least value of $\frac{x}{y}$,

(ii) the least value of x^2+y^2

28. (a) Solve $1-5x\le 5-2x\le 13$

(b) Given that $-3\le x\le 1$ and $-4\le y\le 2$, calculate the greatest value of $xy+x$.

29. Find the integer values of x such that

$2x-6<3x-4<\frac{1}{3}x+6$.

30. Given that x is an integer such that $-4\le x\le 3$ and y is a prime number such that $0<y\le 7$, find

(a) the largest possible value of $\frac{x^2}{y}$,

(b) the least possible value of x^2-y^2

31. Estimate, correct to 1 significant figure,

(a) the value of 0.0124×5036.

(b) the value of $\sqrt{8000}$

(c) $\dfrac{17.31+13.13}{4.041\times\sqrt{898.9}}$

32. (a) Express 0.003186 in standard form

(b) Given $a=7.8\times10^{-1}$ and $b=3.9\times10^{2}$, find the value of each of the following, giving your answer in standard form

(i) $2a+b$

(ii) $\frac{10a}{b}$

33. A helium atom has a mass of 68×10^{-28} kilograms. A steel tank contains 0.8×10^{11} atoms of helium. Find the mass of helium in the tank. Express your answer in standard form.

34. $m=8.1\times10^{3}$ and $n=2.5\times10^{-6}$.

Giving your answers in standard from, find the value of

(a) $\sqrt{m}$

(b) $m\times n$

(c) n^{-1}

35. Given that $p = 0.8 \times 10^{-17}$ and $q = 1.5 \times 10^{-19}$, express the following in standard form:

(a) pq

(b) $\dfrac{q}{p}$

(c) $3p - 2q$

36. Find the value of $x - y$ where $x = 5.1 \times 10^{7}$ and $y = 4.9 \times 10^{6}$. Give your answer in standard form.

37. It is given that $t = 6.4 \times 10^{3}$. Find the value of each of the following, giving your answers in standard form.

(a) $3t$

(b) $t + 1200$

38. (a) Given that $x = 3.6 \times 10^{5}$ and $y = 4 \times 10^{4}$, evaluate xy^2, leaving your answer in standard form.

(b) Expressing your answer in standard form, find $3.45 \times 10^{6} + 5.6 \times 10^{5}$.

39. It is given that $m = 6 \times 10^{8}$ and $n = 2 \times 10^{-3}$. Expressing your answers in standard form, find

(a) $2m \times n$

(b) $\dfrac{m}{n^2}$

40. It is given that

$4205.07 = (4 \times 10^{3}) + (2 \times 10^{2}) + (5 \times 10^{m}) + (7 \times 10^{n})$

where m and n are integers.

Hence, write down the value of m and n

41. The number 4003.06 can be written as

$4 \times 10^{3} + 3 \times 10^{x} + 6 \times 10^{y}$.

Given that x and y are integers, find the values of x and y.

42. Light travels at a speed of approximately 3×10^{5} km/s. Light takes about 8 minutes to reach the Earth from the Sum. How far (in km) is the Earth from the Sun? Express your answer in standard form.

43. (a) Evaluate $45^{0} \times 9^{\frac{3}{2}}$

(b) Simplify $9x^{-5} \div \frac{1}{3}x^{-2}$

44. (a) Evaluate $\left(\frac{4}{25}\right)^{-\frac{1}{2}} \div \left(3\frac{3}{8}\right)^{\frac{2}{3}}$

(b) Hence, find the value of $\dfrac{143 \times 150}{3.8 \times 2.16}$ in standard form.

45. Arrange the following in descending order:

$(-7)^{0}, (-2)^{3}, (-3)^{2}$

46. (a) Find x when $8^{3x-1} = 16$

(b) Evaluate $\left(\frac{3}{5}\right)^{-2} + \left(\frac{3}{5}\right)^{0}$

47. (a) Show that $7^{13} - 7^{11}$ is exactly divisible by 16.

(b) $\dfrac{t \times t^3}{\sqrt{t}} = t^{n}$. Find the value of n.

48. Evaluate

(a) $\left(\frac{3}{2}\right)^{3} + \frac{5}{8} \times \left(\frac{1}{16}\right)^{\frac{1}{2}} - \left(\sqrt{169}\right)^{0}$

(b) $(0.4)^2 - \sqrt[3]{0.027} + 0.2$

49. (a) Evaluate $\dfrac{\sqrt[3]{27^4}}{81} + \left(\frac{1}{2}\right)^{0} \times \left(\frac{1}{8}\right)^{-\frac{2}{3}}$

(b)Estimate the value of $\sqrt{0.0168}$

50. Given that $\dfrac{y^2 \times \sqrt{y}}{y^{-1}} = y^{n}$, find the value of n.