

Dr Oliver Mathematics
Mathematics
Indices
Past Examination Questions

This booklet consists of 35 questions across a variety of examination topics.
The total number of marks available is 130.

1. Simplify $(3 + \sqrt{5})(3 - \sqrt{5})$. (2)
2. Simplify $(\sqrt{7} + 2)(\sqrt{7} - 2)$. (2)
3. Write (2)
$$\sqrt{75} - \sqrt{27}$$

in the form $k\sqrt{x}$, where k and x are integers.
4. Express 9^{3x+1} in the form 3^y , giving y in the form $ax + b$, where a and b are constant.
5. Express 8^{2x+3} in the form 2^y , stating y in terms of x .
6. Find the value of (1)
 - (a) $25^{\frac{1}{2}}$, (1)
 - (b) $25^{-\frac{3}{2}}$. (2)
7. (a) Find the value of $8^{\frac{4}{3}}$. (2)
 - (b) Simplify $\frac{15x^{\frac{4}{3}}}{3x}$. (2)
8. (a) Write down the value of $16^{\frac{1}{4}}$. (1)
 - (b) Simplify $(16x^{12})^{\frac{3}{4}}$. (2)
9. (a) Write down the value of $16^{\frac{1}{2}}$. (1)
 - (b) Find the value of $16^{-\frac{3}{2}}$. (2)
10. (a) Write down the value of $8^{\frac{1}{3}}$. (1)
 - (b) Find the value of $8^{-\frac{2}{3}}$. (2)
11. (a) Write down the value of $125^{\frac{1}{3}}$. (1)

(b) Find the value of $125^{-\frac{2}{3}}$. (2)

12. Given that $32\sqrt{2} = 2^a$, find the value of a . (3)

13. Simplify (4)

$$\frac{5 - \sqrt{3}}{2 + \sqrt{3}}$$

giving your answer in the form $a + b\sqrt{3}$, where a and b are integers.

14. (a) Expand and simplify $(4 + \sqrt{3})(4 - \sqrt{3})$. (2)

(b) Express $\frac{26}{4 + \sqrt{3}}$ in the form $a + b\sqrt{5}$, where a and b are integers. (2)

15. (a) Express $\sqrt{108}$ in the form $a\sqrt{3}$, where a is an integer. (2)

(b) Express $(2 - \sqrt{3})^2$ in the form $b + c\sqrt{3}$, where b and c are integers to be found. (2)

16. Simplify

(a) $(3\sqrt{7})^2$, (1)

(b) $(8 + \sqrt{5})(2 - \sqrt{5})$. (3)

17. (a) Find the value of $16^{-\frac{1}{4}}$. (2)

(b) Simplify $x \left(2x^{-\frac{1}{4}}\right)^4$. (2)

18. Simplify (4)

$$\frac{5 - 2\sqrt{3}}{\sqrt{3} - 1}$$

in the form $p + q\sqrt{3}$, where p and q are rational numbers.

19. Simplify (4)

$$\frac{7 + \sqrt{5}}{\sqrt{5} - 1}$$

in the form $a + b\sqrt{5}$, where a and b are integers.

20. Express (4)

$$\frac{15}{\sqrt{3}} - \sqrt{27}$$

in the form $k\sqrt{3}$, where k is an integer.

21. (a) Write down the value of $32^{\frac{1}{5}}$. (1)

(b) Simplify fully $(32x^5)^{-\frac{2}{5}}$. (3)

22. (a) Evaluate $81^{\frac{3}{2}}$. (2)

(b) Simplify fully $x^2(4x^{-\frac{1}{2}})^2$. (2)

23. (a) Evaluate $32^{\frac{3}{5}}$, giving your answer as an integer. (2)

(b) Simplify fully $\left(\frac{25x^4}{4}\right)^{-\frac{1}{2}}$. (2)

24. Solve the equation (4)

$$10 + x\sqrt{8} = \frac{6x}{\sqrt{2}}.$$

Give your answer in the form $a\sqrt{b}$ where a and b are integers.

25. Solve

(a) $2^y = 8$, (1)

(b) $2^x \times 4^{x+1} = 8$. (4)

26. (a) Find the value of $8^{\frac{5}{3}}$. (2)

(b) Simplify fully (3)

$$\frac{\left(2x^{\frac{1}{2}}\right)^3}{4x^2}.$$

27. (a) Write $\sqrt{80}$ in the form $c\sqrt{5}$, where c is a positive constant. (1)

A rectangle R has a length of $(1 + \sqrt{5})$ cm and an area of $\sqrt{80}$ cm².

(b) Calculate the width of R in cm. Express your answer in the form $p + q\sqrt{5}$, where p and q are integers to be found. (4)

28. Show that

$$\frac{2}{\sqrt{12} - \sqrt{8}}$$

can be written in the form $\sqrt{a} + \sqrt{b}$, where a and b are integers.

29. Simplify

(a) $(2\sqrt{5})^2$, (1)

(b) $\frac{\sqrt{2}}{2\sqrt{5} - 3\sqrt{2}}$, giving your answer in the form $a + \sqrt{b}$, where a and b are integers. (4)

30. Given that $y = 2^x$,

(a) express 4^x in terms of y . (1)

(b) Hence, or otherwise, solve (4)

$$8(4^x) - 9(2^x) + 1 = 0.$$

31. (a) Simplify (2)

$$\sqrt{50} - \sqrt{18},$$

giving your answer in the form $a\sqrt{2}$, where a is an integer.

(b) Hence, or otherwise, simplify (3)

$$\frac{12\sqrt{3}}{\sqrt{50} - \sqrt{18}},$$

giving your answer in the form $b\sqrt{c}$, where b and c are integers.

32. (a) Write $\sqrt{45}$ in the form $a\sqrt{5}$, where a is an integer. (1)

(b) Express (5)

$$\frac{2(3 + \sqrt{5})}{3 - \sqrt{5}}$$

in the form $b + c\sqrt{5}$, where b and c are integers.

33. (a) Expand and simplify $(7 + \sqrt{5})(3 - \sqrt{5})$. (3)

(b) Express (3)

$$\frac{7 + \sqrt{5}}{3 + \sqrt{5}}$$

in the form $a + b\sqrt{5}$, where a and b are integers.

34. (a) Simplify (2)

$$\sqrt{32} + \sqrt{18},$$

giving your answer in the form $a\sqrt{2}$, where a is as integer.

(b) Simplify (4)

$$\frac{\sqrt{32} + \sqrt{18}}{3 + \sqrt{2}},$$

giving your answer in the form $b\sqrt{2} + c$, where b and c are integer.

35. (a) Express (3)

$$(5 - \sqrt{8})(1 + \sqrt{2})$$

in the form $a + b\sqrt{2}$, where a and b are integers.

(b) Express (3)

$$\sqrt{80} + \frac{30}{\sqrt{5}}$$

in the form $c\sqrt{5}$, where c is an integer.