Exponential relationships - practice test 1

16 questions | 42 marks | 60 minutes

Original progressive questions on exact surds, indices, graphs and exponential/logarithmic reasoning.

Equivalent correct methods earn the corresponding marks.

1. Simplify a^5a^2. [2 marks]

Add the exponents: $5+2=7$.

Answer: a^7

2. Simplify $\frac{x^9}{x^4}$ for $x\neq 0$. [2 marks]

Subtract indices: $9-4=5$.

Answer: x^5

3. Evaluate $27^{\frac{2}{3}}$. [2 marks]

The cube root is 3; $3^2=9$.

Answer: 9

4. Write $16^{-\frac{1}{2}}$ as a fraction. [2 marks]

$\sqrt{16}=4$ and the negative index takes the reciprocal.

Answer: $\frac{1}{4}$

5. Simplify $\sqrt{108}$. [2 marks]

$108=36\times 3$.

Answer: $6\sqrt{3}$

6. Simplify $2\sqrt{12}+\sqrt{27}$. [3 marks]

$4\sqrt{3}+3\sqrt{3}=7\sqrt{3}$.

Answer: $7\sqrt{3}$

7. Expand $(3+\sqrt{2})(3-\sqrt{2})$. [2 marks]

The difference of squares is $9-2=7$.

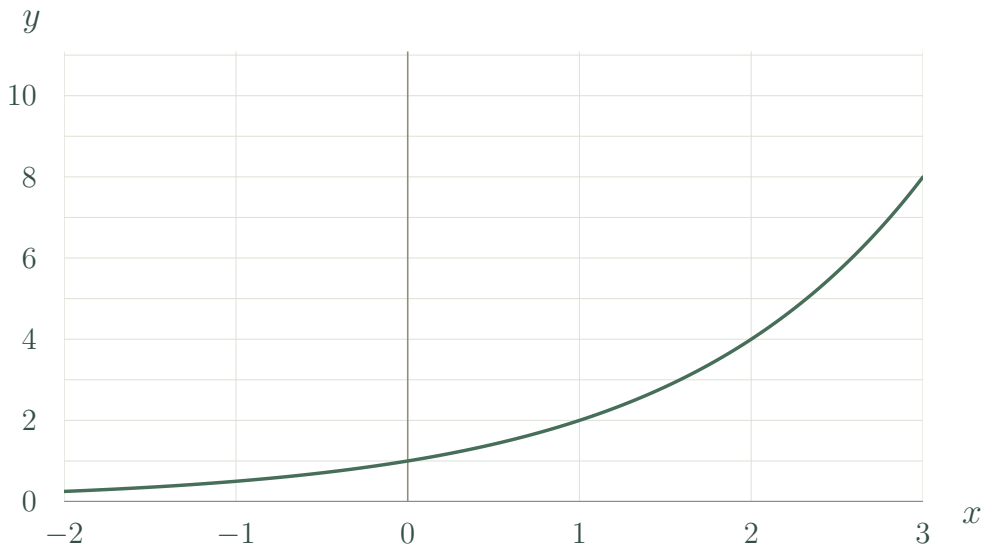
Answer: 7

8. Rationalise $\frac{6}{\sqrt{5}}$. [2 marks]

Multiply top and bottom by $\sqrt{5}$.

Answer: $\frac{6\sqrt{5}}{5}$

9. Use $y=2^x$. [5 marks]



(a) Find the outputs at $x=-1,0,1,2,3$. [2 marks]

Calculate each power, including the reciprocal at $x=-1$.

Answer: $\frac{1}{2}, 1, 2, 4, 8$

(b) Sketch the curve on the grid. Mark its y-intercept and state its horizontal asymptote. [3 marks]

Plot the points and draw a smooth increasing positive curve tending to the horizontal axis.

Answer: Intercept $(0,1)$; asymptote $y=0$.

10. A quantity begins at 250 and grows by 4% per day. Write a model using days t and find its value at $t = 2$. [3 marks]

The factor is 1.04. Evaluate $250(1.04)^2 = 270.4$.

Answer: $Q = 250(1.04)^t$; 270.4.

11. Values at inputs $0, 1, 2, 3$ are $4, 12, 36, 108$. Choose a linear, quadratic or exponential model and give a rule. [3 marks]

Each value is multiplied by 3, starting at 4.

Answer: Exponential: $y = 4(3^x)$.

12. Solve $8^x = 4$. [2 marks]

$2^{3x} = 2^2$, so $3x = 2$.

Answer: $x = \frac{2}{3}$

13. Evaluate $\log_4 64$. [2 marks]

$4^3 = 64$.

Answer: 3

14. Simplify $\log_3 18 - \log_3 2$. [2 marks]

$\log_3 (\frac{18}{2}) = \log_3 9 = 2$.

Answer: 2

15. For $y = 3(2^{x-1}) - 4$, find its horizontal asymptote and y-intercept. [3 marks]

The shift gives the asymptote. At zero, $\frac{3}{2} - 4 = -\frac{5}{2}$.

Answer: $y = -4$ and $(0, -\frac{5}{2})$.

16. A model is fitted to the data below. [5 marks]

Observed model quantity

Day t	0	1	2
N	40	60	90

(a) Find an exponential model for the three observations. [2 marks]

The initial value is 40 and both ratios are 1.5.

Answer: $N = 40(1.5)^t$

(b) Predict at day 3, then give one reason to be cautious about using the model at day 100. [3 marks]

$40(1.5)^3 = 135$. Capacity or changing conditions can invalidate long-term exponential growth.

Answer: 135; the growth factor may change.