# OCR 03 Indices and surds (Higher)

1. Work out .
2. Write  in the form , where *a* is an integer.
3. Simplify . Write your answer in standard form.
4. Calculate .
5. Simplify .
6. The area *A* of a circle with radius *r* is given by the formula .

Calculate the area of a circle with radius cm, giving your answer in terms of .

1. Work out .
2. Calculate the **exact** area of this triangle.



1. Simplify .
2. Find  when . Give your answer in standard form.
3. Neil writes . Is Neil correct? Explain your answer.
4. Show that .
5. Which of the following numbers is the largest? Show how you decide.



1. Venus is km from the Sun. Neptune is km from the Sun.

Zoe wants to know how much further Neptune is from the Sun than Venus is from the sun.

Her calculation is shown below.



km

Her calculation is incorrect. Show how Zoe should have done the calculation.

1. Show that .
2. Ceredig thinks of a number. He raises it to the power 0.25 and gets the answer 3. What number did Ceredig first think of?
3. The number is called one googol. How many googols is the number?
4. Dave’s garden is square. It has an area of 130 m2. Without using a calculator, estimate the length of Dave’s garden to the nearest metre.
5. When a car skids to a stop, the speed *s* in miles per hour that the car was travelling when it started to skid can be calculated by using the formula , where *f* is the coefficient of friction and *d* is the length of the skid marks in feet.

A car skids to a stop on a road with a speed limit of 40 miles per hour. The skid marks measure 42 feet, and the coefficient of friction was 0.7. Work out the exact speed the car was travelling when it started to skid and say whether it was speeding.

1. The area *A* of a regular hexagon of side length *S* is given by the formula .

Calculate the area of a regular hexagon with side length cm.

Give your answer in the form  where *k* and *c* are rational numbers.

### Answers

1.  or 0.04
2. 
3. 
4. 2
5. 
6. 



1. 





1. Area 

cm2 or cm2 (answer must not be a decimal approximation).

1. 



 or 

1. 



1. Yes, with explanation. To divide we subtract indices (), so answer is .
2. , , 
3. , , , 

so  is the largest.

1. 

km or km in standard form.

Alternatively, 

km

1. 





1.  so 



1. 

so  is 300 googols.

1. ,  so  lies between11 and 12.

 so  and length is 11 m to the nearest metre.

1. 

mph

(to 1 dp) and  so car is not speeding.

1. 

cm2

(where  and )

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| **Assessment Objective** | **Qu.** | **Topic** | **R** | **A** | **G** |  | **Assessment Objective** | **Qu.** | **Topic** | **R** | **A** | **G** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AO1 | 1 | Calculate with integer powers |  |  |  |  | AO1 | 1 | Calculate with integer powers |  |  |  |
| AO1 | 2 | Calculate integer powers |  |  |  |  | AO1 | 2 | Calculate integer powers |  |  |  |
| AO1 | 3 | Add numbers in standard form |  |  |  |  | AO1 | 3 | Add numbers in standard form |  |  |  |
| AO1 | 4 | Calculate with fractional powers |  |  |  |  | AO1 | 4 | Calculate with fractional powers |  |  |  |
| AO1 | 5 | Simplify expressions with surds, including rationalising denominators |  |  |  |  | AO1 | 5 | Simplify expressions with surds, including rationalising denominators |  |  |  |
| AO1 | 6 | Use surds in exact calculations |  |  |  |  | AO1 | 6 | Use surds in exact calculations |  |  |  |
| AO1 | 7 | Calculate with fractional powers and roots |  |  |  |  | AO1 | 7 | Calculate with fractional powers and roots |  |  |  |
| AO1 | 8 | Use surds in exact calculations |  |  |  |  | AO1 | 8 | Use surds in exact calculations |  |  |  |
| AO1 | 9 | Calculate with fractional powers and roots |  |  |  |  | AO1 | 9 | Calculate with fractional powers and roots |  |  |  |
| AO1 | 10 | Calculate with integer powers |  |  |  |  | AO1 | 10 | Calculate with integer powers |  |  |  |
| AO2 | 11 | Know and apply laws of indices |  |  |  |  | AO2 | 11 | Know and apply laws of indices |  |  |  |
| AO2 | 12 | Calculate with fractional powers and roots |  |  |  |  | AO2 | 12 | Calculate with fractional powers and roots |  |  |  |
| AO2 | 13 | Calculate with integer and fractional powers |  |  |  |  | AO2 | 13 | Calculate with integer and fractional powers |  |  |  |
| AO2 | 14 | Calculate with numbers in standard form |  |  |  |  | AO2 | 14 | Calculate with numbers in standard form |  |  |  |
| AO2 | 15 | Simplify expressions with surds, including rationalising denominators |  |  |  |  | AO2 | 15 | Simplify expressions with surds, including rationalising denominators |  |  |  |
| AO3 | 16 | Calculate fractional powers |  |  |  |  | AO3 | 16 | Calculate fractional powers |  |  |  |
| AO3 | 17 | Calculate using standard form |  |  |  |  | AO3 | 17 | Calculate using standard form |  |  |  |
| AO3 | 18 | Estimate powers and roots to the nearest whole number without using a calculator |  |  |  |  | AO3 | 18 | Estimate powers and roots to the nearest whole number without using a calculator |  |  |  |
| AO3 | 19 | Solve a problem by manipulating surds |  |  |  |  | AO3 | 19 | Solve a problem by manipulating surds |  |  |  |
| AO3 | 20 | Know and apply laws of indices |  |  |  |  | AO3 | 20 | Know and apply laws of indices |  |  |  |