# OCR 04 Approximation and Estimation (Higher)

1. Round 33 179 614 to the nearest thousand.
2. Round 63.87 419 to 2 decimal places.
3. Round 0.24 581 to 3 significant figures.
4. Round 28 537.5159 to 2 significant figures.
5. Round  to 3 significant figures.
6. The side length of a square is 124 cm correct to the nearest centimetre.

Write down the error interval for its perimeter (*p*).

1. The radius of a circle is 8.39 cm truncated to two decimal places.

Write down the error interval for its area (*a*).

1. Estimate the answer to .
2. Estimate what percentage of £36 277 is £7682.
3. Carl counted the number of steps he took to walk from his house to the station to be 3678. He estimates that his stride is approximately 58 cm. Estimate the distance from Carl’s house to the station.
4. Fredo walked the 1536 miles from Bug End to Mount Doum in 198 days. Estimate how many miles he walked per day on average, and evaluate the reliability of this estimate.
5. The attendance at a football match (*n*) was given as 17 800 to the nearest hundred people. Rakesh says that the error interval can be written as , where *n* is the number of people. Paula says that the error interval is .

State if each of them is correct, and explain your answer.

1. A roll of edging tape is stated to be 150 m long correct to the nearest 10 metres. A cushion maker uses 2.4 m of edging tape, correct to the nearest 10 cm, for each cushion he makes. Show that the number of cushions he can make is in the range 59 to 65.
2. A rectangular field is 110 m wide and 170 m long, each distance correct to the nearest 10 m. A path crosses the field diagonally. Show that the difference between the longest and shortest possible length of the path is greater than 10 m.
3. Lev wants to estimate the height of a tree in his garden. He stands on horizontal ground 20 m (to the nearest 10 cm) from the base of the tree. The height of his eyes above the ground is

168 cm to the nearest cm. The angle of elevation from his eyes to the top of the tree is 38° to the nearest degree By considering bounds, show that the tree is between 17 and 18 metres tall.

1. In the UK, large eggs must be of a certain weight,  large g. Henrietta has 1 kg of large eggs. What is the range of the number of large eggs she has?
2. The distance from London to New York is 5552 km to the nearest kilometre. A plane flies from London to New York in 6 hours 45 minutes correct to the nearest minute. Calculate the lower bound for the speed of the plane. Give your answer correct to 3 significant figures.
3. An elephant has a weight of 2860 N to 3 significant figures. Assume that the area of each foot in contact with the ground is a circle of radius 16 cm to the nearest centimetre. Calculate the upper bound for the pressure that the elephant would exert on the ground when standing on all four feet. Use the formula  and give your answer in N/m2.
4. Arthur and Mary want to put a fence around their rectangular paddock. Fence panels are sold in 5 m lengths. Arthur measures the length and width of the paddock to be 46 m and 90 m both correct to the nearest metre. Mary measures the length and width of the paddock to be 46.00 m and 90.00 m both correct to the nearest 10 centimetres. Would Arthur’s measurements and Mary’s measurements result in different numbers of fence panels needed?
5. The density of steel (*d*) varies within the range g/cm3. A company manufactures cylindrical steel rods that have a radius of 160 mm and a length of 8470 mm, both given to the nearest millimetre. For quality assurance, the company proposes to accept a rod if its weight (*w*) is in the range 5250-5500 kg correct to the nearest 10 kg. Calculate the bounds for the weight of the rods, and comment on the proposal.

### Answers

1. 33 180 000
2. 63.87
3. 0.246
4. 29 000
5. 
6. 494  *p* < 498
7. 221.14  *a* < 221.67
8. 
9. 
10. 3678  4000. 58 cm  60 cm. 4000 × 60  240 000 cm  2400 m  2.4 km.
11. . This estimation is not likely to be reliable as the distance is rounded up by almost a third of its original value, whereas the time is rounded up by only a small amount. The number of miles per day is therefore an overestimate.
12. Both Rakesh and Paula are correct. The error interval can be given as either  or  because the number of people can only be a whole number.
13. length of roll m

length of roll per cushion m

Minimum number of cushions  so 59

Maximum number of cushions  so 65

Range  59-65

1. Difference in length 





 which is greater than 10 m

20 tan (38)

Height of tree

38°

168 cm

20 m

Lower bound for height of tree m

Upper bound for height of tree m

so the tree is between 17 and 18 metres tall.

1. 



Range is 14-16 eggs (or 2 eggs).

1. Need km/h
2. .

Upper bound for pressure N/m2 to 3sf.

1. Arthur: Upper bound for perimeter  2(46.5 + 90.5)  274 m, so he would calculate

274 ÷ 5  54.8 i.e. 55 fence panels.

Mary: Upper bound for perimeter  2(46.05 + 90.05)  272.2 m, so she would calculate

272.2 ÷ 5  54.44 i.e. 55 fence panels.

Therefore the measurements do not result in different numbers of fence panels needed.

1. Lower bound for weight kg.

Upper bound for weight kg.

Allowable range (*r*) is kg. The lowest possible weight is in range but the highest possible weight is outside the allowable range and therefore it is possible that some of the rods could be rejected.

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| **Assessment Objective** | **Qu.** | **Topic** | **R** | **A** | **G** |  | **Assessment Objective** | **Qu.** | **Topic** | **R** | **A** | **G** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AO1 | 1 | Round to the nearest thousand |  |  |  |  | AO1 | 1 | Round to the nearest thousand |  |  |  |
| AO1 | 2 | Round to 2 decimal places |  |  |  |  | AO1 | 2 | Round to 2 decimal places |  |  |  |
| AO1 | 3 | Round to 3 significant figures |  |  |  |  | AO1 | 3 | Round to 3 significant figures |  |  |  |
| AO1 | 4 | Round a large number to 2 significant figures |  |  |  |  | AO1 | 4 | Round a large number to 2 significant figures |  |  |  |
| AO1 | 5 | Round a number given in standard form to 3 significant figures |  |  |  |  | AO1 | 5 | Round a number given in standard form to 3 significant figures |  |  |  |
| AO1 | 6 | Write an error interval for continuous data |  |  |  |  | AO1 | 6 | Write an error interval for continuous data |  |  |  |
| AO1 | 7 | Write an error interval for a truncated value |  |  |  |  | AO1 | 7 | Write an error interval for a truncated value |  |  |  |
| AO1 | 8 | Estimate the answer to a calculation involving division by a decimal |  |  |  |  | AO1 | 8 | Estimate the answer to a calculation involving division by a decimal |  |  |  |
| AO1 | 9 | Estimate a percentage |  |  |  |  | AO1 | 9 | Estimate a percentage |  |  |  |
| AO1 | 10 | Estimate the answer to a calculation involving a product |  |  |  |  | AO1 | 10 | Estimate the answer to a calculation involving a product |  |  |  |
| AO2 | 11 | Estimate in context |  |  |  |  | AO2 | 11 | Estimate in context |  |  |  |
| AO2 | 12 | Explain bounds for discrete data |  |  |  |  | AO2 | 12 | Explain bounds for discrete data |  |  |  |
| AO2 | 13 | Calculate with bounds |  |  |  |  | AO2 | 13 | Calculate with bounds |  |  |  |
| AO2 | 14 | Calculate with bounds |  |  |  |  | AO2 | 14 | Calculate with bounds |  |  |  |
| AO2 | 15 | Use bounds in a real-life context |  |  |  |  | AO2 | 15 | Use bounds in a real-life context |  |  |  |
| AO3 | 16 | Calculate with bounds |  |  |  |  | AO3 | 16 | Calculate with bounds |  |  |  |
| AO3 | 17 | Find a lower bound for speed |  |  |  |  | AO3 | 17 | Find a lower bound for speed |  |  |  |
| AO3 | 18 | Find an upper bound for pressure |  |  |  |  | AO3 | 18 | Find an upper bound for pressure |  |  |  |
| AO3 | 19 | Consider how the accuracy of measurements affects the answer to a calculation |  |  |  |  | AO3 | 19 | Consider how the accuracy of measurements affects the answer to a calculation |  |  |  |
| AO3 | 20 | Solve a problem using bounds |  |  |  |  | AO3 | 20 | Solve a problem using bounds |  |  |  |