Approximations and Error: exam practice

10 questions · 30 marks · worked solutions and markschemes

Name _____ Date _____ Score / 30

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlai/approximations-and-error-exam-practice

1. **2 marks · Paper 1 style · calculator allowed**

Calculate $\dfrac{(4.2 \times 10^5) \times (3.6 \times 10^{-2})}{1.8 \times 10^3}$, giving your answer in the form $a \times 10^k$.

Find the value. **[2]**

2. **2 marks · Paper 1 style · calculator allowed**

Maya estimates the area of a field as $2400\ \text{m}^2$. The actual area is $2257\ \text{m}^2$.

Find the percentage error in her estimate. **[2]**

3. **3 marks · Paper 1 style · calculator allowed**

A red blood cell has diameter 7.5×10^{-6} m.

Find how many red blood cells, placed side by side, would stretch 3 cm. Give your answer in the form $a \times 10^k$. **[3]**

4. **3 marks · Paper 2 style · calculator allowed**

A car travels 250 km, correct to the nearest 10 km, in 3.2 hours, correct to the nearest 0.1 hour.

Find the upper bound of the average speed. **[3]**

5. **3 marks · Paper 1 style · calculator allowed**

The length of a side of a square is 6 cm, correct to the nearest cm.

Find the difference between the upper and lower bounds of the area. **[3]**

6. **2 marks · Paper 1 style · calculator allowed**

Let $v = \dfrac{\sqrt{48.3}}{2.71^2}$.

(a) Write down the value of v correct to 4 decimal places. **[1]**

(b) Write your answer to part (a) correct to 2 significant figures. **[1]**

7. **4 marks · Paper 1 style · calculator allowed**

The distance from the Earth to the Sun is about $149\,600\,000$ km.

(a) Write this distance in the form $a \times 10^k$, where $1 \leq a < 10$, $k \in \mathbb{Z}$. **[2]**

(b) Light travels at 3.00×10^5 km per second. Find the time light takes to reach the Earth, in minutes. **[2]**

8. **3 marks · Paper 1 style · calculator allowed**

A rectangle has length 12.4 cm and width 7.6 cm, both measured to the nearest 0.1 cm.

(a) Write down the upper bound of the length. **[1]**

(b) Find the lower bound of the area. **[2]**

9. **4 marks · Paper 1 style · calculator allowed**

The radius of a circle is measured as 8.5 cm to the nearest 0.5 cm. The exact area is calculated from this measurement.

(a) Write down the lower and upper bounds of the radius. **[1]**

(b) Find the maximum percentage error in the area if 8.5 cm is used. **[3]**

10. **4 marks · Paper 2 style · calculator allowed**

The volume of a sphere of radius r is $V = \frac{4}{3}\pi r^3$. A ball has radius 11.6 cm.

(a) Find the volume, correct to 3 significant figures. **[2]**

(b) Jo uses $r = 12$ cm to estimate the volume. Find the percentage error in her estimate. **[2]**

Answers and worked solutions

Question 1 — 2 marks

Answer: 8.4×10^0

$\frac{15\,120}{1800}$ **M1**

8.4×10^0 **A1**

Question 2 — 2 marks

Answer: 6.34%

$\left|\frac{2400 - 2257}{2257}\right| \times 100$ **M1**

6.34% **A1**

Question 3 — 3 marks

Answer: 4×10^3

$3\text{ cm} = 0.03\,m$ **A1**

$\frac{0.03}{7.5 \times 10^{-6}}$ **M1**

4×10^3 **A1**

Question 4 — 3 marks

Answer: $81.0\,\text{km/h}$

$\frac{255}{3.15}$ *M*1**A1**

$81.0\,\text{km/h}$ **A1**

Question 5 — 3 marks

Answer: 12 cm^2

bounds 5.5 and 6.5 **A1**

$6.5^2 - 5.5^2$ **M1**

12 cm^2 **A1**

Question 6 — 2 marks

Answer: (a) 0.9463; (b) 0.95

(a)

0.9463 **A1**

(b)

0.95 **A1**

Question 7 — 4 marks

Answer: (a) 1.496×10^8 km; (b) 8.31 minutes

(a)

1.496×10^8 km **A2**

(b)

$\frac{1.496 \times 10^8}{3 \times 10^5} = 498.7\,s$ **M1**

8.31 minutes **A1**

Question 8 — 3 marks

Answer: (a) 12.45 cm; (b) 93.2 cm^2

(a)

12.45 cm **A1**

(b)

12.35×7.55 **M1**

93.2 cm^2 **A1**

Question 9 — 4 marks

Answer: (a) 8.25 cm and 8.75 cm; (b) 5.97%

(a)

$8.25 \leq r < 8.75$ **A1**

(b)

$A = \pi(8.5)^2 = 226.98$, $A_{\max} = \pi(8.75)^2 = 240.53$

*M*1**A1**

5.97% **A1**

Question 10 — 4 marks

Answer: (a) 6540 cm^3; (b) 10.7%

(a)

$\frac{4}{3}\pi(11.6)^3$ **M1**

6540 cm^3 **A1**

(b)

$\frac{\frac{4}{3}\pi 12^3 - 6538.2}{6538.2} \times 100$ **M1**

10.7% **A1**

Every solution is also on ibmathrevision.com/hlai/approximations-and-error-exam-practice
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