EXERCISES [MAI 1.1]

NUMBERS – ROUNDING – PERCENTAGE ERROR

SOLUTIONS

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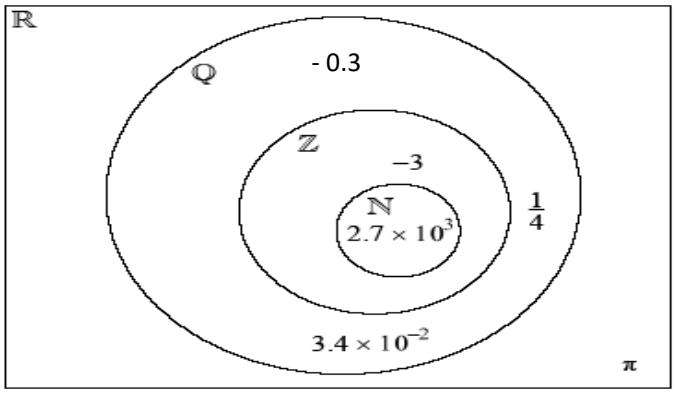
A. Paper 1 questions (SHORT)

NUMBERS AND ROUNDING

1.



2. (a) 1.6×10^{-19}, 9.8×10^{-18}, π, 3.5, 0.006073×10^6, 60730, 6.073×10^5

(b) π is irrational.

3. (a) (i) 1352.41 (ii) 1350 (iii) 1400

(b) (i) 0.00014 (ii) 0.000135 (iii) 0.00014

(c) 1.35×10^3

(d) 1.35×10^{-4}

4. (a) $w = (2.6 \times 10^4) \times (5.0 \times 10^{-8})$
$= 13 \times 10^{-4}$ or 0.0013 (if written as working)
$= 1.3 \times 10^{-3}$

(b) Statements (ii) and (iv) are incorrect.

5. (a) 2.79×10^{-6}

(b) 1.024×10^{-2} (Accept 1.02×10^{-2})

6. (a) $s = 3.14 \times 10^2$

(b) $p = 0.00314$

(c) 0.3454 (0.345)

(d) 3.454×10^{-1} (3.45×10^{-1})

7. (a) (i) $mn = 6.0 \times 2.4 \times 10^{-2} = 14.4 \times 10^{-2} = (1.44 \times 10^{1}) \times 10^{-2} = 1.44 \times 10^{-1}$

(ii) $\frac{m}{n} = \frac{6.0}{2.4} \times 10^{8} = 2.5 \times 10^{8}$

(iii) $m^2 = (6.0 \times 10^{3})^2 = 36 \times 10^{6} = 3.6 \times 10^{7}$

(b) $m + n = 6000.000024$

8. (a) $34450 \leq x < 34550$

(b) $0.03005 \leq y < 0.03015$

(c) $15.295 \leq z < 15.305$

(d) $144.5 \leq w < 145.5$

9. (a) 471.03

(b) (i) 471

(ii) 4.71×10^2 or 4.71028×10^2 or 4.7103×10^2

10. (a) 0.0337

(b) (i) 0.034

(ii) 3.4%

(c) 3.4×10^{-2}

11. (a) $\frac{4.24}{256} = 0.0165625$

(b) 0.0166

(c) 1.66×10^{-2}

12. (a) 162 cm or 1.62 m

(b) 2 hours 45 minutes or 165 minutes

(c) 2600

(d) 3.84403×10^5 or 3.84×10^5

13. (a) $h = \sqrt{0.03625^2 - \frac{0.05^2}{4}}$

$= 0.02625$

(b) 0.026

(c) 0.0263

(d) 2.625×10^{-2}

14. (a) $1225 \leq x < 1235$

(b) $1230^2 - 1225^2 = 1512900 - 1500625 = 12275$

PERCENTAGE ERROR

15.

Exact value of x	**Approximated** value of x	**Percentage error** (exact or in 3 sf)
100	103	3%
100	97	3%
103	100	2.91%
97	100	3.09%
1000	1003	0.3%
10	13	30%
34567	34600 (3sf)	0.0955%
0.34567	0.346 (3sf)	0.0955%

16. (a) 1.265×10^{-1}

(b) $0.13\ (1.3 \times 10^{-1})$

(c) $\dfrac{0.13-0.1265}{0.1265} \times 100\% = 2.77\%$

17. (a) $p = 1.775 - \dfrac{\sqrt{1.44}}{48} = 1.75 \quad \left(1.750, \dfrac{7}{4}\right)$

(b) (i) $x = 2, y = 1, z = 50$

(ii) $p = 1.98 \left(\dfrac{99}{50}\right)$

(c) $\dfrac{1.98-1.75}{1.75} \times 100 = 13.1\%$

18. (a) 29.7675

(b) 30

(c) $\dfrac{30-29.7675}{29.7675} \times 100\% = 0.781\%$

(d) $7.81 \times 10^{-1}\%$ (7.81×10^{-3} with no percentage sign)

PROBLEMS

19. (a) $9.5 \times 10^2 \times 1.6 \times 10^3 = 1.52 \times 10^6$ m^2

(b) $\dfrac{1600000 - 1520000}{1520000} \times 100 = 5.26$ % (percent sign not required).

20. (a) $(2.6 \times 10^4)(1.9 \times 10^4) = 4.94 \times 10^8$

(b) $2(2.6 \times 10^4) + 2(1.9 \times 10^4) = 9.0 \times 10^4$ (9×10^4)

21. (a) $144.75 \left(= \dfrac{579}{4}\right)$ **Note:** Accept 145

(b) 1.4475×10^2 **Note:** Accept 1.45×10^2

(c) (i) Area = 96m^2 (unit penalty)

(ii) % error = $\dfrac{(96-90)}{90} \times 100 = \dfrac{6 \times 100}{90} = \dfrac{20}{3}$% or 6.67%

22. (a) $(2680 + 1970) \times 2 = 9.30 \times 10^3$ cm

(b) $2680 \times 1970 = 5279600 = 5{,}280{,}000$ (5280 thousand)

23. (a) $V = 16 \times 1\dfrac{3}{4} \times 2\dfrac{2}{3} = 74.6666... = 74\dfrac{2}{3}\text{m}^3 \left(\dfrac{224}{3}\text{m}^3\right)$ ***Unit penalty (UP)***

(b) % error = $\dfrac{\left(90 - 74\dfrac{2}{3}\right) \times 100}{74\dfrac{2}{3}} = 20.5$ **Note:** Accept –20.5.

24. (a) $V = \pi 4.26^2(21.58 - 14.35) = 412.1994(123)$

(b) 412.20

(c) 410

(d) 4.10×10^2

25. (a) $V = \sqrt{\dfrac{500^3}{36\pi}} = 1051.305... = 1051.31$ cm^3

(b) 1051

(c) 1.051×10^3

26. (a) $50 \times 100 \times 40 = 200000$ cm^3 ***Unit penalty applies in part (a)***

(b) $\dfrac{200000}{500} = 400$

(c) $\dfrac{400 - 350}{350} \times 100 = 14.3\%$

27. (a) *6900 km*

(b) $2\pi(6900) = 43354$

(c) 4.3354×10^4

28. (a) $(2\pi \times 150\,000\,000) / 365 = 2\,580\,000$ km

(b) 2.58×10^6