

<b>Complete solutions to Intro(f)</b>
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1. (a) (i) The fourth place after the decimal point in 1.618034 is 0 and because  $0 < 5$  so we leave the 8 intact:

$$1.618034 = 1.618 \text{ (3 d.p.)}$$

(ii) For 2 d.p. we examine the third decimal place which is 8 and since 8 is greater than 5 so we increase the 1, next to 8, to 2:

$$1.618034 = 1.62 \text{ (2 d.p.)}$$

(b) (i) 4.6692 is already written to 4 d.p.

(ii) For 2 d.p. we weigh up the third place after the decimal point which is 9 and  $9 > 5$ , so we increase the adjacent 6 to 7:

$$4.6692 = 4.67 \text{ (2 d.p.)}$$

(c) Similarly (i) 2.503 (3 d.p.)      (ii) 2.5 (1 d.p.)

(d) (i) For 3 d.p. we inspect the fourth number after the decimal point

$$0.373 \underbrace{9}_\text{fourth number} 6$$

which is 9 so we increase the 3, next to 9, to 4:

$$0.37396 = 0.374 \text{ (3 d.p.)}$$

(ii) 0.37 (2 d.p.)

2. (a) (i) Since we are interested in writing 1.618034 to 3 s.f., we examine the fourth number which is 8 and 8 is greater than 5 so we increase the 1 to 2:

$$1.6 \underbrace{1}_\text{increase this to 2} 8034 = 1.62 \text{ (3 s.f.)}$$

(ii) For 2 s.f. we weigh up the third number from the left

$$1.6 \underbrace{1}_\text{third number} 8034$$

Because 1 is less than 5, so the 6 remains untouched:

$$1.618034 = 1.6 \text{ (2 s.f.)}$$

(b) (i) For 5 s.f. we examine the sixth figure from the left

$$2.9732 \underbrace{1}_\text{sixth number} 4$$

which is 1 and of course 1 is less than 5 so the adjacent 2 remains as 2:

$$2.973214 = 2.9732 \text{ (5 s.f.)}$$

(ii) For 2 s.f. we look at the third number from the left, which is 7, so we increase the 9 to 10. Hence

$$2.973214 = 3.0 \text{ (2 s.f.)}$$

(c) (i) The first significant digit is the 1 immediately following the decimal point, as this is the first non-zero digit. To write to 4 s.f. we need to examine the fifth digit afterwards, which is the third zero

$$0.1100 \underbrace{0}_\text{fifth digit} 1$$

Hence to 4 s.f. the answer is 0.1100.

Note that trailing zero's following the decimal point are **always** significant. (Trailing zeros before a decimal point may or may not be significant, thus 23 048 is 23 000 for both 2 s.f. and 3 s.f.!)

(ii) To write 0.110001 to 1 s.f. we need to examine the second non-zero number from the left which is 1 and of course  $<5$ , so we drop it. Hence

$$0.1 \underbrace{1}_{\substack{\text{second} \\ \text{number}}} 0001$$

$$0.110001 = 0.1 \text{ (1 s.f.)}$$

(d) (i) For 2 s.f. of 9.869 we inspect the third number from the left which is 6 and 6 is greater than 5, so we increase 8 to 9:

$$9.869 = 9.9 \text{ (2 s.f.)}$$

(ii) For 1 s.f. we look at the second number from the left which is 8 and 8 is greater than 5 so the 9 goes to 10:

$$9.869 = 10 \text{ (1 s.f.)}$$

3. (a)  $1729 = 1700$  (2 s.f.)

(b) For 2 s.f. we weigh up the third number from the left which is 9 and so the preceding 9 increases to 10:

$$99954 = 100000 \text{ (2 s.f.)}$$

(c) The third number from the left is 7 and it is greater than 5 so we increase the 0 to 1:

$$107928278317 = 110000000000 \text{ (2 s.f.)}$$

4. (a)  $\pi = 3.14159\dots$  To write this to 2 d.p. we inspect the third decimal place which is 1, hence

$$\pi = 3.14 \text{ (2 d.p.)}$$

$e = 2.71828\dots$  To 2 d.p. we inspect the third place after the decimal point which is 8 and 8 is greater than 5 so we increase the 1 to 2:

$$e = 2.72 \text{ (2 d.p.)}$$

Similarly  $\sqrt{2} = 1.414\dots$  we have

$$\sqrt{2} = 1.41 \text{ (2 d.p.)}$$

(b) For 2 s.f. in each case we just need to write down the first 2 figures because the third digit from the left in each case is less than 5. Hence

$$\pi = 3.1 \text{ (2 s.f.)} \quad e = 2.7 \text{ (2 s.f.)} \quad \sqrt{2} = 1.4 \text{ (2 s.f.)}$$