Complex numbers Ex 13.1 Q1(i)

We know that $i = \sqrt{-1}$

$$i^2 = -1$$
$$i^3 = -i$$
$$i^4 = 1$$

In order to find i^n where $n > 4$, we divide n by 4 to get quotient p and remainder q, so that

$$n = 4p + q, o \le q < 4$$

Then $i^n = i^{4p+q}$

$$= i^{4p} \times i^q$$
$$= \left(i^4\right)^p \times i^q$$
$$= 1^p \times i^q$$
$$= i^q \qquad \left[\because 1^{p-1}\right]$$

Hence $i^n = i^q$, *where* $o \le q < 4$

$$\therefore i^{457} = i^{4\times 114} \times i^1$$
$$= i^1$$
$$= i$$

Complex numbers Ex 13.1 Q1(ii)

We know that $i = \sqrt{-1}$

$$i^2 = -1$$
$$i^3 = -i$$
$$i^4 = 1$$

In order to find i^n where $n > 4$, we divide n by 4 to get quotient p and remainder q, so that

$$n = 4p + q, o \le q < 4$$

Then $i^n = i^{4p+q}$

$$= i^{4p} \times i^q$$
$$= \left(i^4\right)^p \times i^q$$
$$= 1^p \times i^q$$
$$= i^q \qquad \left[\because 1^{p-1}\right]$$

Hence $i^n = i^q$, *where* $o \le q < 4$

$$\therefore i^{528} = i^{4\times 132}$$
$$= \left(i^4\right)^{132}$$
$$= 1^{132}$$
$$= 1$$

$$\therefore \left(i^{528}\right) = 1$$

Complex numbers Ex 13.1 Q1(iii)

We know that $i = \sqrt{-1}$

$$i^2 = -1$$
$$i^3 = -i$$
$$i^4 = 1$$

In order to find i^n where $n > 4$, we divide n by 4 to get quotient p and remainder q, so that

$$n = 4p + q, o \le q < 4$$

Then $i^n = i^{4p+q}$

$$= i^{4p} \times i^q$$
$$= \left(i^4\right)^p \times i^q$$
$$= 1^p \times i^q$$
$$= i^q \qquad \left[\because 1^{p-1}\right]$$

Hence $i^n = i^q$, *where* $o \le q < 4$

$$\therefore \frac{1}{i^{58}} = \frac{1}{i^{4\times14} \times i^2}$$
$$= \frac{1}{1 \times i^2}$$
$$= \frac{1}{-1} \qquad \left[\because i^2 = -1\right]$$
$$= -1$$

Complex numbers Ex 13.1 Q1(iv)

We know that $i = \sqrt{-1}$

$$i^2 = -1$$
$$i^3 = -i$$
$$i^4 = 1$$

In order to find i^n where $n > 4$, we divide n by 4 to get quotient p and remainder q, so that

$$n = 4p + q, o \le q < 4$$

Then $i^n = i^{4p+q}$

$$= i^{4p} \times i^q$$
$$= \left(i^4\right)^p \times i^q$$
$$= 1^p \times i^q$$
$$= i^q \qquad \left[\because 1^{p-1}\right]$$

Hence $i^n = i^q$, *where* $o \le q < 4$

$$\therefore i^{37} + \frac{1}{i^{67}} = i^{4\times9} \times i^1 + \frac{1}{i^{4\times16} \times i^3}$$
$$= 1 \times i^1 + \frac{1}{1 \times i^3}$$
$$= i + \frac{1}{i^3 \times i} \times i$$
$$= i + \frac{i}{i^4}$$
$$= i + \frac{i}{1} \qquad \left[\because i^4 = 1\right]$$
$$= 2i$$

$$\therefore i^{37} + \frac{1}{i^{67}} = 2i$$

*********** END **********