2022A1 REACTIVE AND APPARENT POWER

ANSWERS

Level 1: To solve this question, we can follow the formula given to us:

$$Apparent\ Power = \sqrt{Real\ Power^2 + Reactive\ Power^2}$$

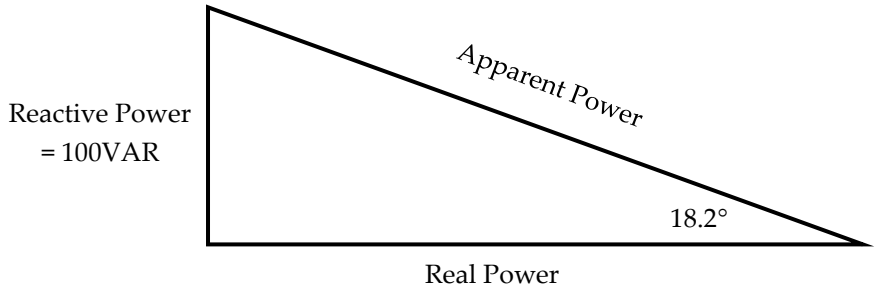
With 15 W of real power and 3 VAR of reactive power, we need to plug these values into the equation and simplify the equation.

$$Apparent\ Power = \sqrt{15^2 + 3^2}$$

$$Apparent\ Power = \sqrt{225 + 9}$$

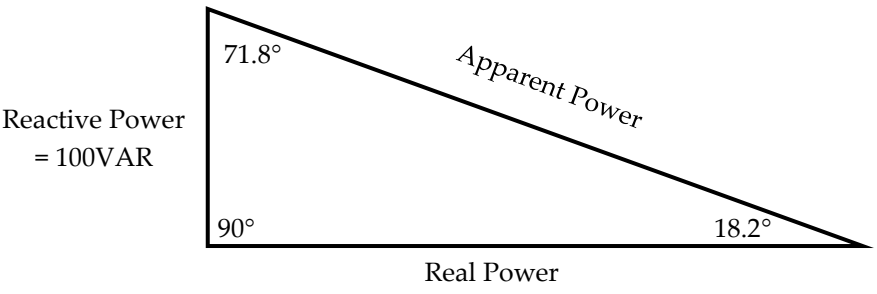
$$Apparent\ Power = \sqrt{234} = 15.3\ VA$$

Level 2: Let's start with what we know from the problem description.



We also know that one of the angles must be 90°, because real power and reactive power are distinct from each other. Also, the interior angles of a triangle must add up to 180°. We have two of those measurements, 90° and 18.2°, so the third angle must be 71.8°.

Let's review our triangle with all the information that we have now.



With these angles, we can solve for the sides in a number of ways. For example, we can use the angle of theta (18.2°) to calculate the apparent power with some trigonometric functions.

$$\sin(\theta) = \frac{Opposite}{Hypotenuse}$$

$$\sin(18.2°) = \frac{Reactive\ Power}{Apparent\ Power}$$

$$0.312 = \frac{100}{Apparent\ Power}$$

$$\frac{1}{0.312} = \frac{Apparent\ Power}{100}$$

$$Apparent\ Power = 320.5\ VA$$

We can solve for real power with another trigonometric function, or we could use the equation from the Level 1 question!

$$Apparent\ Power = \sqrt{Real\ Power^2 + Reactive\ Power^2}$$

$$320.5 = \sqrt{Real\ Power^2 + 100^2}$$

$$102{,}720 = 10{,}000 + Real\ Power^2$$

$$9{,}994 = Real\ Power^2$$

$$Real\ Power = 304.5W$$

One Energy's turbines help power large scale commercial and industrial electric consumers. These consumers must balance their load, meaning they must be careful to minimize their generation of reactive power!