Topic: Newton's Law of Cooling

Question: The function T models the temperature (in Celsius) of a cooling object. What is the starting temperature of the object?

$$T(t) = 14e^{-5t}$$

Answer choices:

A $5^\circ\ C$

B $14^\circ\ C$

C $8^\circ\ C$

D $7^\circ\ C$

Solution: B

The starting temperature of the object is given by T when $t = 0$. So substitute $t = 0$ into the temperature function.

$$T(t) = 14e^{-5t}$$

$$T(0) = 14e^{-5(0)}$$

$$T(0) = 14e^{0}$$

$$T(0) = 14(1)$$

$$T(0) = 14$$

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Question: The function T models the temperature (in Celsius) of a cooling object. What is the approximate temperature of the object after 1 hour?

$$T(t) = 8e^{-t}$$

Answer choices:

A $0^\circ\ C$

B $1^\circ\ C$

C $8^\circ\ C$

D $3^\circ\ C$

Solution: D

The temperature of the object after 1 hour is given by T when $t=1$. So substitute $t=1$ into the temperature function.

$$T(t)=8e^{-t}$$

$$T(1)=8e^{-1}$$

$$T(1)\approx 8(0.37)$$

$$T(1)\approx 3$$

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Question: The function T models the temperature (in Celsius) of a cooling object. How many hours does it take to cool the object to 100°?

$$T(t) = 124e^{-0.6t}$$

Answer choices:

A $\quad 0.35$ hours

B $\quad 0.70$ hours

C $\quad 3.5$ hours

D $\quad 7.0$ hours

Solution: A

The time it takes to cool the object to 100° is given by T when $T = 100$. So substitute $T = 100$ into the temperature function.

$$T(t) = 124e^{-0.6t}$$

$$100 = 124e^{-0.6t}$$

$$0.81 = e^{-0.6t}$$

Apply the natural logarithm to both sides.

$$\ln 0.81 = \ln e^{-0.6t}$$

$$-0.21 = -0.6t$$

$$t = \frac{-0.21}{-0.6}$$

$$t = 0.35$$