Topic: Work done by a variable force

Question: Calculate the variable force done over the interval with the given force equation.

$$F(x) = x^2$$

on the interval $[1,3]$

Answer choices:

A $\dfrac{28}{3}$

B $\dfrac{26}{3}$

C   3

D   8

Solution: B

To find the work done by a variable force, we use the work formula

$$W = \int_a^b F(x)\ dx$$

where $F(x)$ is the variable force equation, $[a, b]$ is the given interval and W is the work done.

Plugging the values we've been given into the formula, we get

$$W = \int_1^3 x^2\ dx$$

$$W = \frac{1}{3}x^3 \Big|_1^3$$

$$W = \frac{1}{3}(3)^3 - \frac{1}{3}(1)^3$$

$$W = \frac{27}{3} - \frac{1}{3}$$

$$W = \frac{26}{3}$$

Topic: Work done by a variable force

Question: Calculate the variable force done over the interval with the given force equation.

$$F(x) = 2\sin 4x$$

on the interval $[0,\pi]$

Answer choices:

A π

B   0

C   4

D   2

Solution: B

To find the work done by a variable force, we use the work formula

$$W = \int_a^b F(x) \, dx$$

where $F(x)$ is the variable force equation, $[a, b]$ is the given interval and W is the work done.

Plugging the values we've been given into the formula, we get

$$W = \int_0^\pi 2 \sin 4x \, dx$$

$$W = -\frac{2}{4} \cos 4x \, \bigg|_0^\pi$$

$$W = -\frac{1}{2} \cos 4x \, \bigg|_0^\pi$$

$$W = -\frac{1}{2} \cos 4\pi - \left[-\frac{1}{2} \cos 4(0) \right]$$

$$W = -\frac{1}{2}(1) + \frac{1}{2}(1)$$

$$W = 0$$

Topic: Work done by a variable force

Question: Calculate the variable force done over the interval with the given force equation.

$$F(x) = x^3 - 4e^{2x}$$

on the interval $[0,4]$

Answer choices:

A $62 - 2e^8$

B $64 - 2e^8$

C $64 - 2e^4$

D $66 - 2e^8$

Solution: D

To find the work done by a variable force, we use the work formula

$$W = \int_a^b F(x) \, dx$$

where $F(x)$ is the variable force equation, $[a, b]$ is the given interval and W is the work done.

Plugging the values we've been given into the formula, we get

$$W = \int_0^4 x^3 - 4e^{2x} \, dx$$

$$W = \frac{1}{4}x^4 - \frac{4}{2}e^{2x} \Big|_0^4$$

$$W = \frac{1}{4}x^4 - 2e^{2x} \Big|_0^4$$

$$W = \frac{1}{4}(4)^4 - 2e^{2(4)} - \left[\frac{1}{4}(0)^4 - 2e^{2(0)}\right]$$

$$W = 64 - 2e^8 + 2(1)$$

$$W = 66 - 2e^8$$