1. A cart is moving horizontally along a straight line with constant speed of 20 m/s.A projectile is to be fired from the moving cart so that it returns to the same cart after the cart has moved 60 m.The speed with which the projectile must be fired with respect to the cart is:

1) 5 m/s ;
2) 10 m/s ;
3) 15 m/s ;
4) 20 m/s .

$v = 20\frac{m}{s}$ $l = 60\,m$ $g = 10\frac{m}{s^2}$	*Solution.* We should assume that the projectile is fired in vertical direction. The time of its flight is $t = \frac{l}{v}$ (the cart moves with the constant speed). The movement of the projectile is under the force of gravity (with the constant acceleration g), so the initial velocity and the acceleration are connected as $v_1 = g \cdot t$.
$v_1 - ?$	

Taking into account the reversing movement (down to the earth), one can express the total time of flight of the projectile:

$$t = \frac{2v_1}{g}.$$

Let equate the time expressions.

$$\frac{l}{v} = \frac{2v_1}{g}.$$

We can find the initial velocity of the projectile:

$$v_1 = \frac{g\,l}{2v}.$$

Let check the dimension.

$$[v_1] = \frac{\frac{m}{s^2} \cdot m}{\frac{m}{s}} = \frac{m}{s}.$$

Let evaluate the quantity.

$$v_1 = \frac{10 \cdot 60}{2 \cdot 20} = 15\left(\frac{m}{s}\right).$$

Answer: 3).