Down to Earth
KS3

Example Sheet

Impactor Speed

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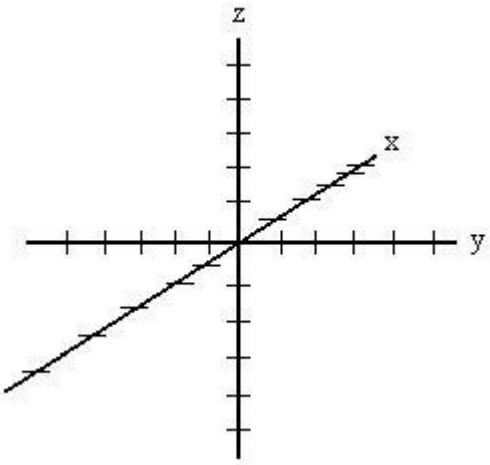
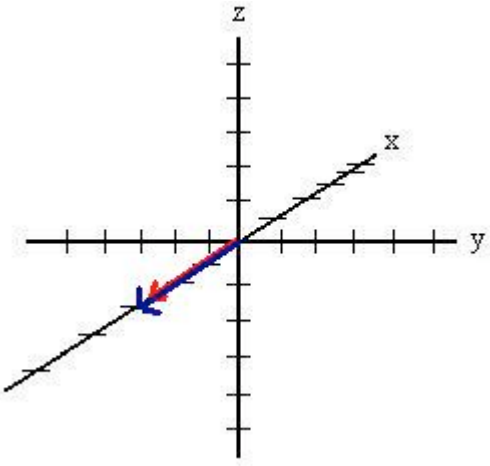
Impactor Speed

Example sheet

Consider two cars involved in a rear-end collision (both moving in the same direction). If both cars are moving at the time they collide, it isn't the velocity of the first car or the second car that would be used to calculate the energy of impact, it's the difference between them. So a car traveling at 60 mph striking a car traveling 55 mph transfers the same amount of energy at collision as a car traveling 5 mph striking a stationary car.



Remember that in 3-dimensions this equation is used to get an object's true velocity (velocity is a vector).



Let's say that the cars were moving along the x-axis. This means that their velocities (in mph) along the three axes would be:

Car 1: (60, 0, 0)
Car 2: (55, 0, 0)

This means that the overall velocities of the cars would be:

Car 1: $v = \left|\sqrt{x^2 + y^2 + z^2}\right| = \left|\sqrt{(60)^2 + (0)^2 + (0)^2}\right|$ = 60 mph

Car 2: $v = \left|\sqrt{x^2 + y^2 + z^2}\right| = \left|\sqrt{(55)^2 + (0)^2 + (0)^2}\right|$ = 55 mph

What is important though is how fast the cars are moving relative to each other.

In this case the cars have are traveling along the x-axis so we only have one dimension to think about. This is a simplified situation and in the case of the Deep Impact mission we must think about the 3 velocity components of the comet and the impactor.

The relative velocity of the second car to the first car will be: (55-60, 0-0, 0-0) or (-5, 0, 0).

This means the overall relative velocity of the second car to the first is:

$$v = \left|\sqrt{x^2 + y^2 + z^2}\right| = \left|\sqrt{(-5)^2 + (0)^2 + (0)^2}\right|$$

= 5 mph