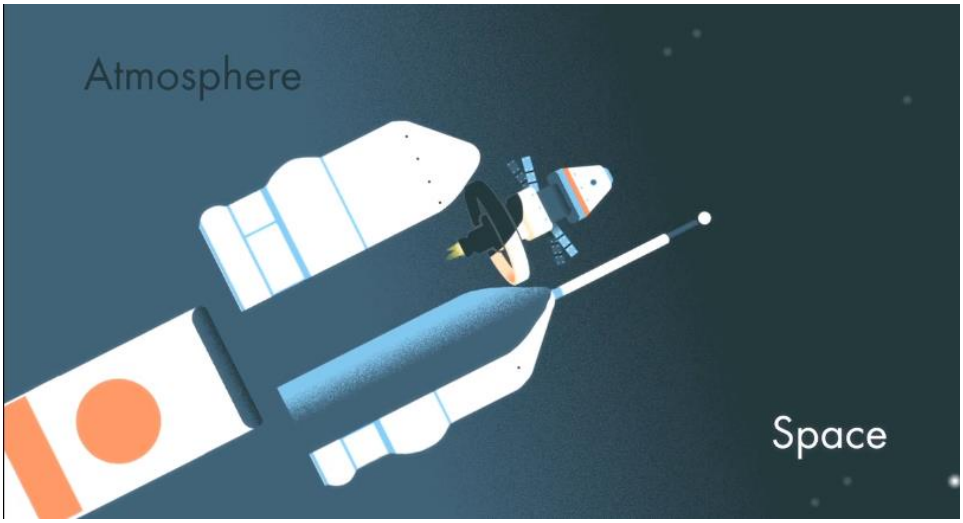
ROYAL OBSERVATORY GREENWICH

# Resultant Force and Acceleration

Key Stage 4 (higher)

**Topics covered:** forces as vectors, standard form, resultant forces, acceleration, Newton's First and Second Laws of Motion

Watch the video "Newton's Laws of Motion", https://vimeo.com/159043081




Objects experience many forces which determine their movement. Forces have size and direction (they are vector quantities), unlike the mass of an object which has a size but no assigned direction – mass is a scalar quantity. Newton determined that the acceleration, a ($m/s^2$), of an object in a particular direction is proportional to the overall or net force, F (N), in that direction. This relationship is shown below where m is the mass of the object in kg.

$$F = ma$$

Rearrange this equation to find 'a' and 'm'.

$$a = \qquad and \qquad m =$$

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**Instructions:**

- Cut out the 10 cards on the following pages.
- On each card, there is a value that needs to be calculated - stated in the bottom left corner. E.g. Find 'a'
- The solution to the problem is found on **another card** - stated in the top left corner. E.g. 6.8 $m/s^2$
- Like a game of dominoes, the cards can be matched together and the solution for the final card should be stated in the top left corner of the first card.

***NB: You can start with any card – the cards loop around full circle so there's no particular start or end. The answer in the top left corner is linked to the previous card and is unrelated to the problem on that particular card.***

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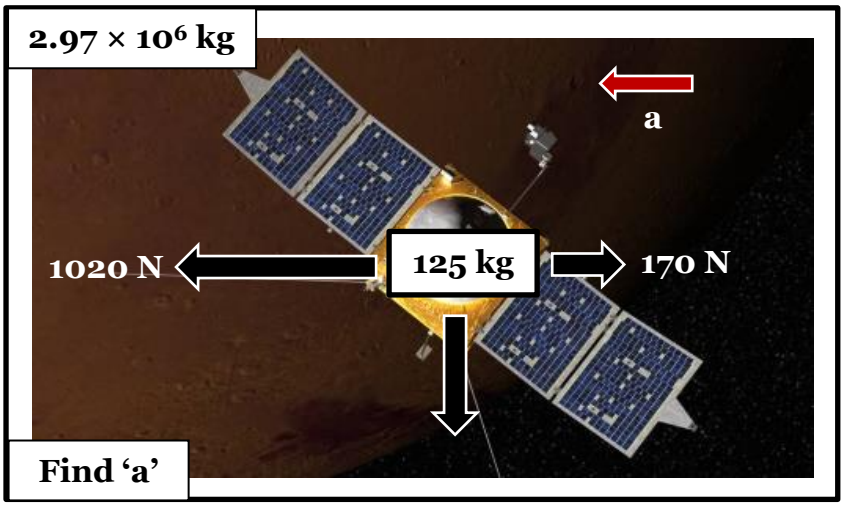
**To begin:**

In the problem below, the acceleration in the horizontal direction needs to be calculated.

Use the formula for 'a' that you rearranged above to find the acceleration.
The mass of the probe is 125 kg.
First, you will need to work out the overall force in the horizontal direction.

$a =$

Find the card with this solution, place it beneath this first card and continue by solving the problem on the second card.



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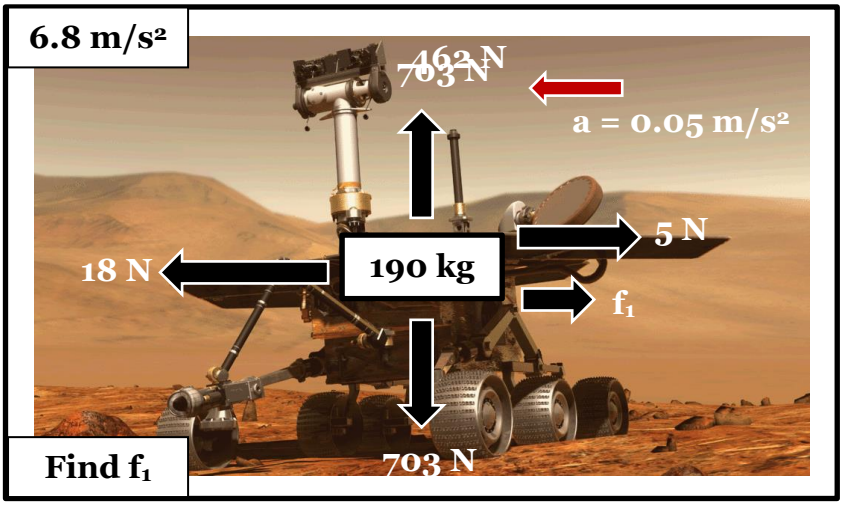


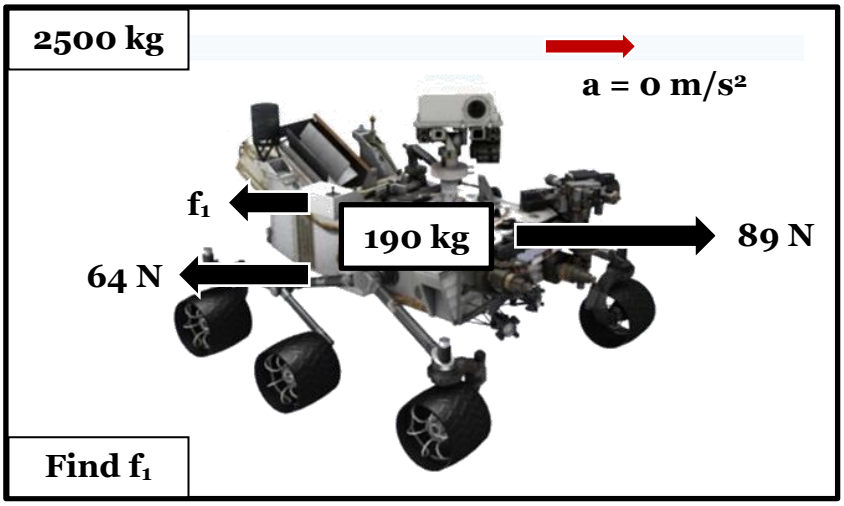


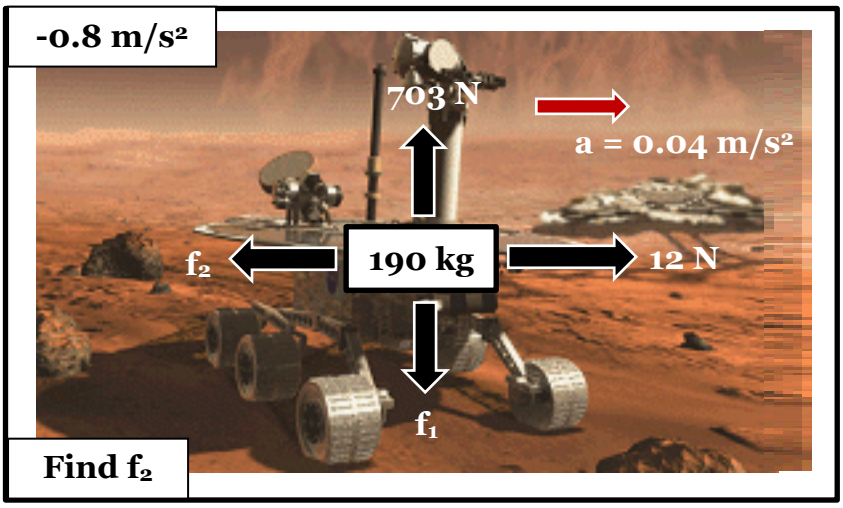

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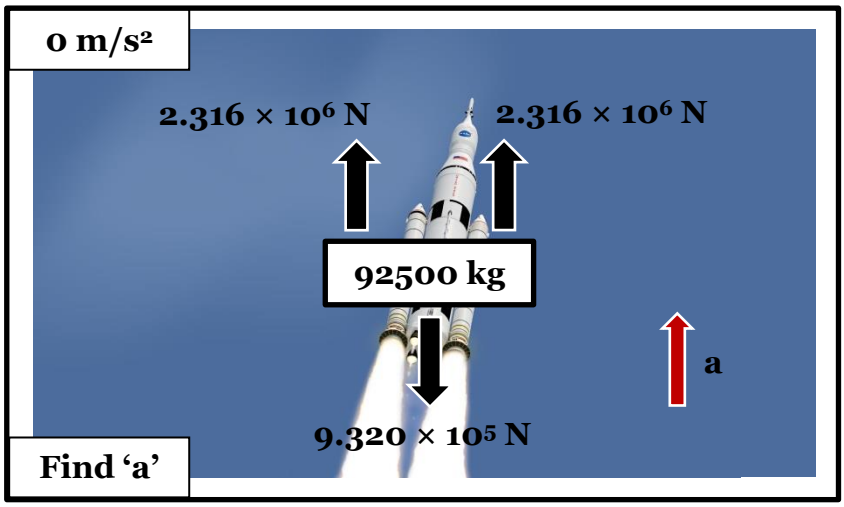


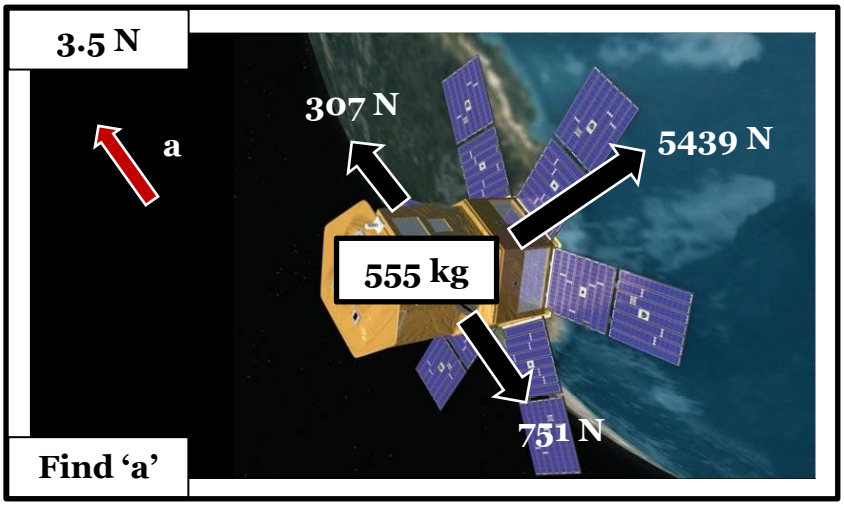


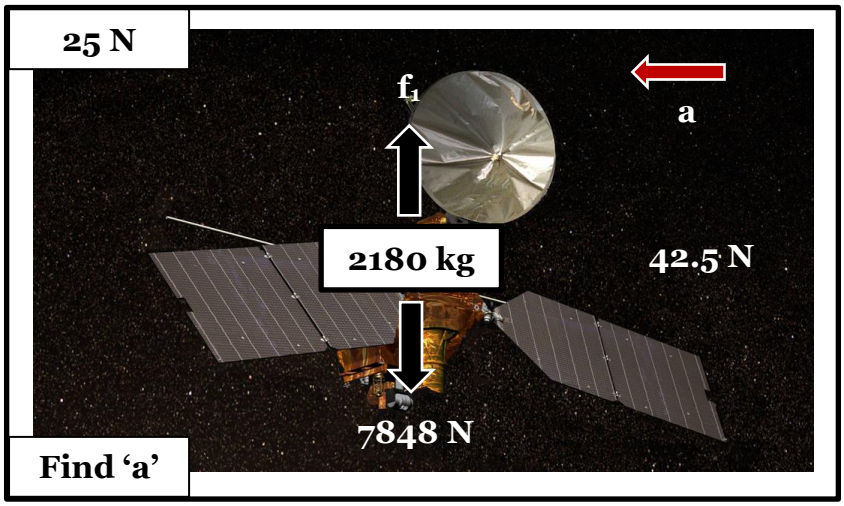

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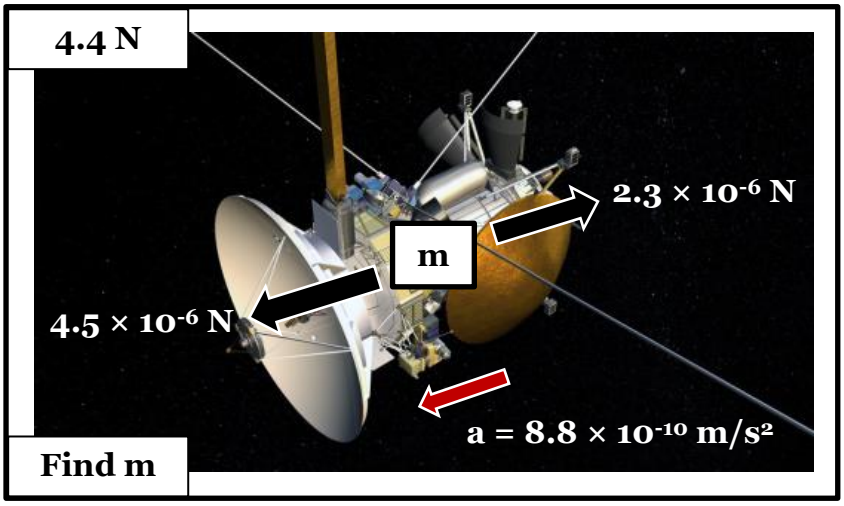


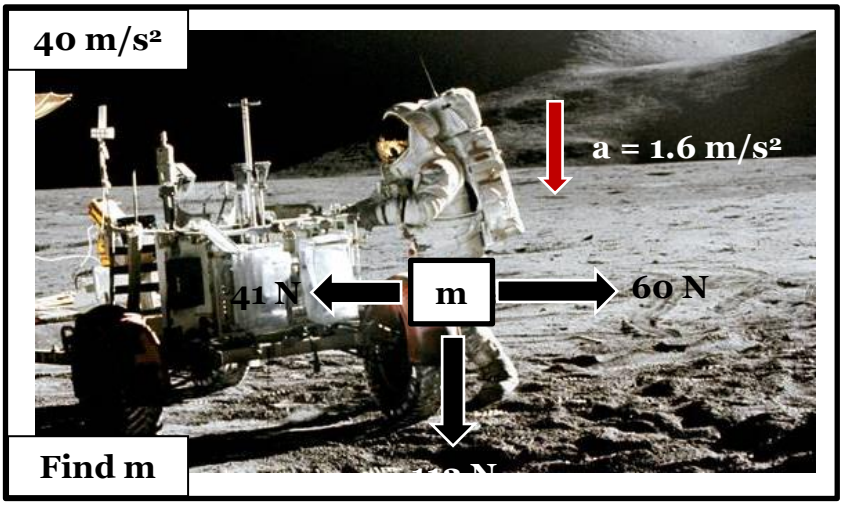


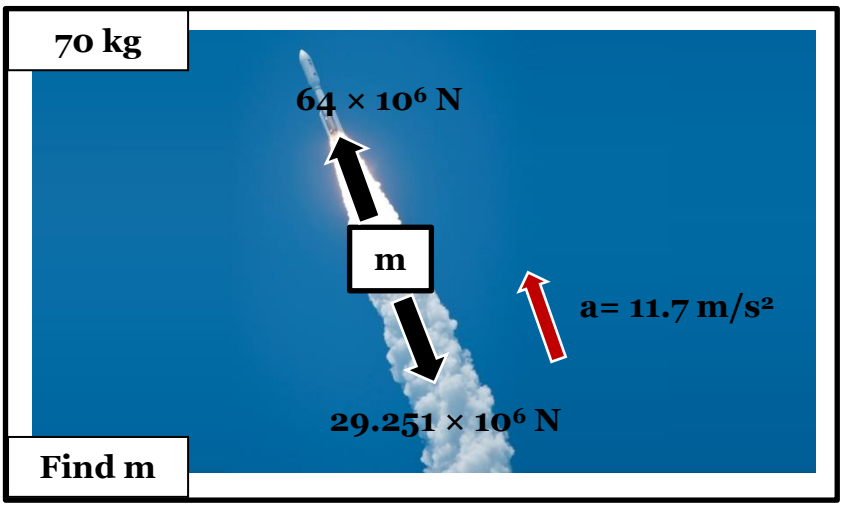

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# Resultant Forces and Acceleration: ANSWERS

## Key Stage 4 (higher)

$$a = \frac{F}{m} \qquad and \qquad m = \frac{F}{a}$$