

# A1

**Simplify:**  $\frac{81}{256} \times \frac{125}{729} \times \frac{64}{15}$

**Answer:**

# B1

Find the minimum value of  $f(x) = x^{2024} + x^{1012} - 1$

**Answer:**

# A2

A couple would like to have a daughter.  
How many children should they have so that there is at least a  
90% chance of having a daughter?

Answer:

# B2

Calculate  $1 + 2 + 4 + 8 + 16 + \dots + 32768$

**Answer:**

# A3

A cyclic quadrilateral  $PQRS$  with center  $O$  is such that  $\angle POR$  has size  $x^\circ$ .  
Find in terms of  $x$  the size of  $\angle PQR$ .

**Answer:**

# B3

Solve  $u^2 - u - 1 = 0$   
and hence find the minimum value of  $f(x) = x^{2024} - x^{1012} - 1$

**Answer:**

The point  $(6, 4)$  undergoes a series of transformations.

First it is rotated by  $90^\circ$  about point  $(1, 1)$ .

Then it is reflected across  $y = -x$ .

It is then translated by  $(3, 2)$ , before being stretched by scale factor 3 from the origin.

What is the final coordinate?

**Answer:**

# B4

What is the area of the rectangle inscribed between the  $x$  - *axis*,  
 $y = 9 - x^2$  and with a corner at  $(2, 5)$

**Answer:**



A pound sterling is made of 20 *shillings*.

A shilling is made of 12 *pence*.

A *halfpennysworth* is half a penny's worth.

A *sixpence* is worth 6 *pennies*.

A *florin* is worth 2 *shillings*.

A *half crown* is worth 2.5 *shillings*, and a *crown* is worth  
2 *half crowns* (obviously).

You buy 4 items from a store, three are £3, 15 shillings and 7 pence, and the other is £2, 10 shillings and 3 and a half pence.

What is the minimum number of coins you would use to pay for these.

Answer:

# B5

A pound sterling is made of 20 *shillings*.

A shilling is made of 12 *pence*.

A *halfpennysworth* is half a penny's worth.

A *sixpence* is worth 6 *pennies*.

A *florin* is worth 2 *shillings*.

A *half crown* is worth 2.5 *shillings*, and a *crown* is worth 2 *half crowns* (obviously).

You buy 3 items from a store, two are £1, 18 shillings and 4 pence, and the other is £2, 5 shillings and 1 and a half pence.

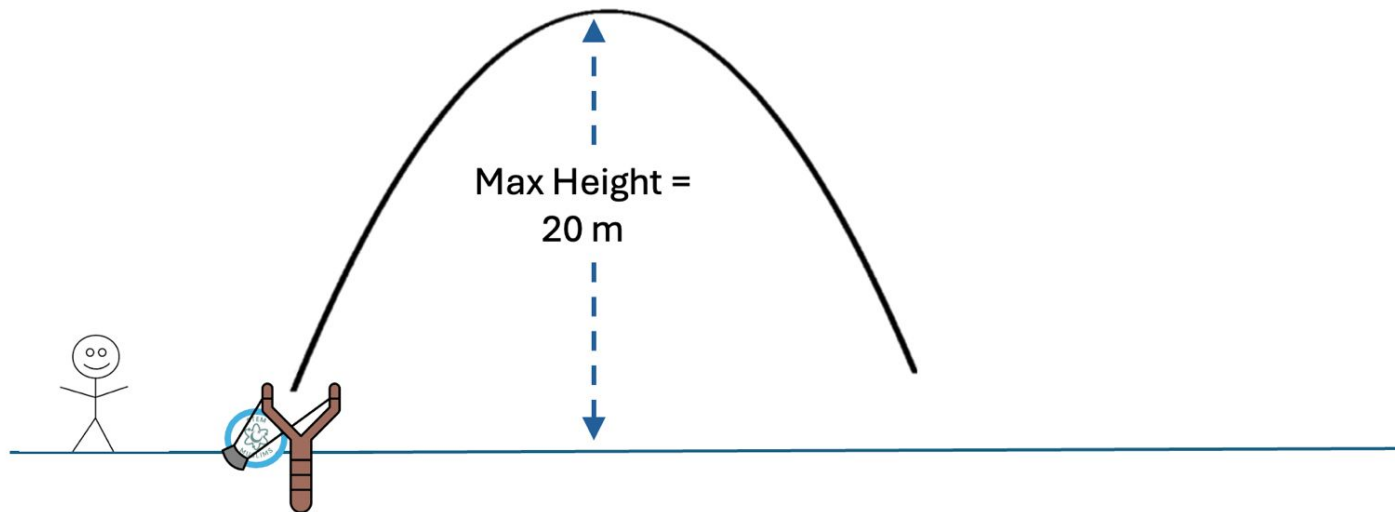
What is the minimum number of coins you would use to pay for these.

Answer:

# A6

Sharif decides to fire a rock from his slingshot into the air from the ground.

Given that it was fired at  $50\text{ms}^{-1}$ , how long was it in the air?  
Give your answer in terms of  $g$



You can assume the ball starts and lands on ground level at 0 m.

Figure 1:  
Sharif firing the slingshot

## Answer:

# B6

Sharif kicks a STEMM ball down a hill.

Given that the process is 90% efficient, what is the final velocity?  
Give your answer in terms of  $g$

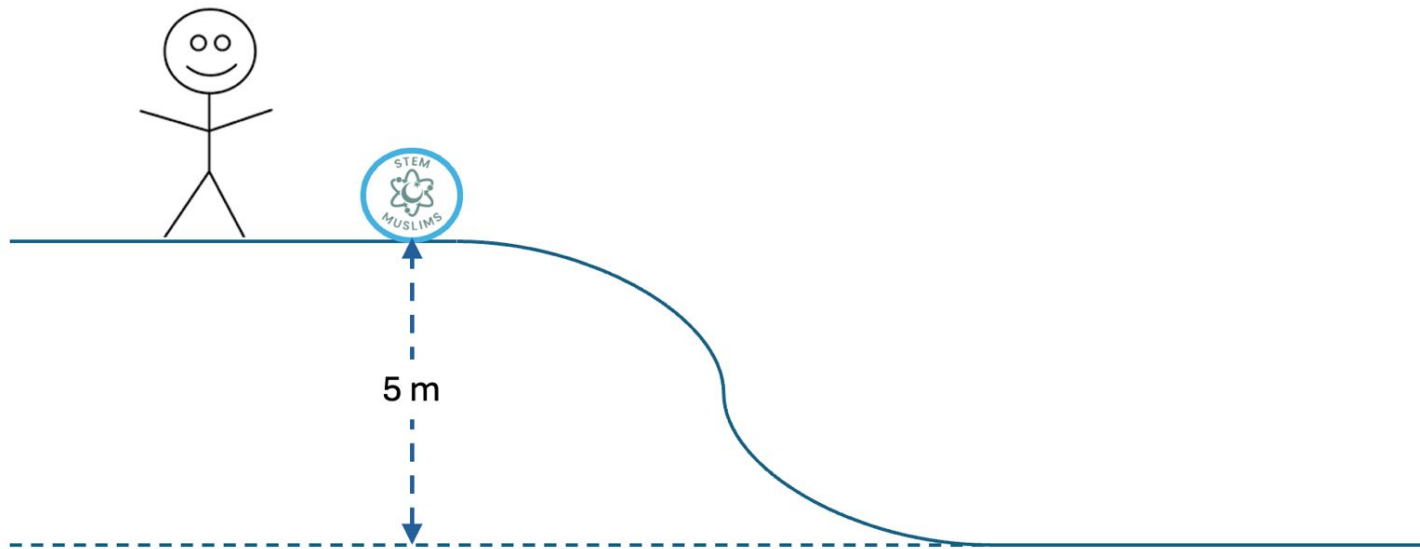


Figure 2:  
Sharif kicking a ball

**Answer:**

# A7

Find the total resistance of this circuit in terms of  $R$

$$R_{total} = \left( \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n} \right)^{-1}$$

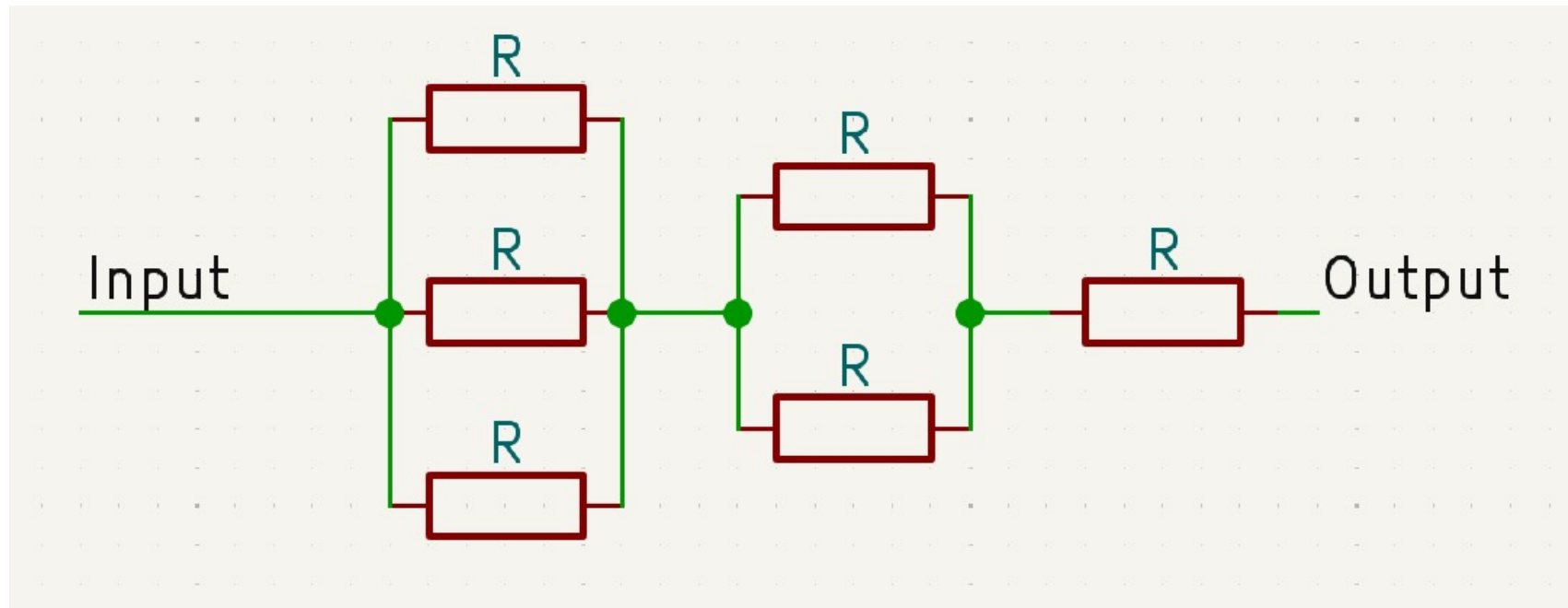


Figure 3:  
A circuit

**Answer:**

You only have resistors of resistance  $R$ .  
Draw a circuit with total resistance  $\frac{11}{3}R$

$$R_{total} = \left( \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n} \right)^{-1}$$

**Answer:**

