PWTV television is starting a new show called "The Ultimate Celebrity Face-off." It is a race between the greatest celebrity action heroes.

In Episode 1, Jackie Chan and Chuck Norris will "face-off" in 4 challenges. The celebrity to complete ALL challenges in the shortest time will be crowned "Champion", and his choice of charity will receive a donation amount based on his performance.

Your task is to calculate how long it takes for the contestants to complete each challenge in seconds, determine who will be crowned "Champion!", and how much his charity will receive.

* *Please note that:* $speed = \frac{distance}{time}$

Challenge 1- The Race of Champions

Both Jackie and Chuck have to run the same "Race of Champions" from the start line to the finish line. The value of x is 6 meters.
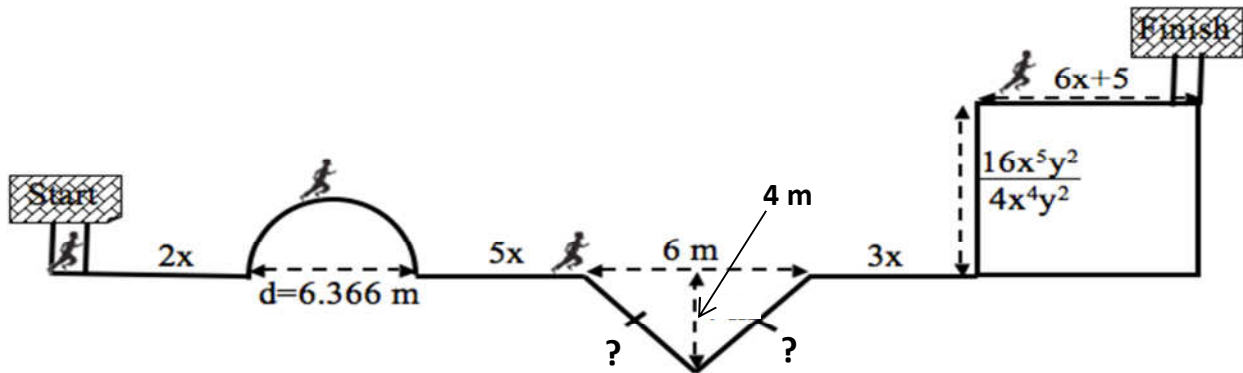
Jackie runs and climbs at an average speed of 1.25 m/s.

After the timer starts, Chuck wastes 10 seconds to sign a few autographs at the start line. Then, after those first 10 seconds, he runs and climbs at a constant average speed to the finish. His distance and time were noted randomly twice and recorded in the table below.

Chuck's Race Information

| Time (s)	Distance from Start (m)
10	0
90	100

Challenge 2- Flying into the Stratosphere

In order to prepare for Challenge 3, Jackie and Chuck must fly in hot air balloons to the same height in the sky.

Jackie's balloon starts at an elevation of 345 m. He travels upwards at 19 m/s.

Chuck's balloon starts at an elevation of 660 m. After 18 seconds Chuck's elevation is 876 m.

How long does it take for Jackie and Chuck to reach the same elevation? What is this elevation?
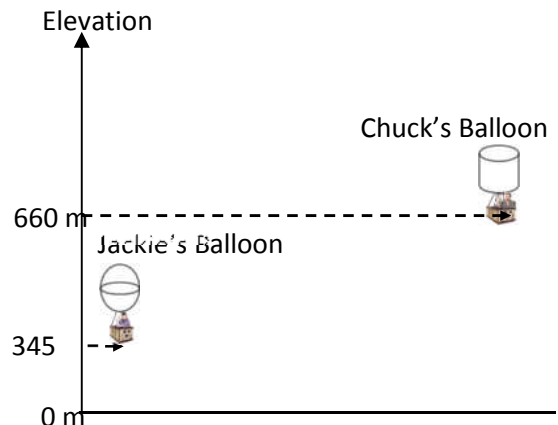
Challenge 3- Zip-lining Down to Safety

Once Jackie and Chuck reach the same elevation (i.e. the elevation determined in Challenge 2), they are to zip-line along the ropes tied from their balloons onto target (T) at ground level.

Jackie is wearing baggy clothing, so he travels along his zip-line at a speed of 20 m/s.

Chuck is wearing a streamline speed suit and travels at a speed of 74 m/s along his zip-line.
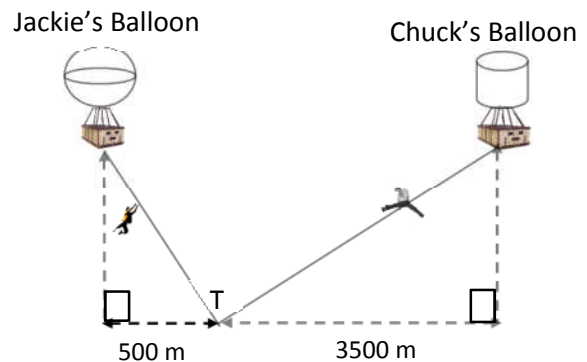
Challenge 4- The Feat of Strength

In the final challenge, Jackie and Chuck will each pull a bus all the way around a rectangular course once. The contestants do not race around the same course, but both rectangular courses have equal areas.

Jackie runs at 5.25 m/s, and Chuck runs at 2 m/s.

Jackie's – City Run

$3x$ $A = 16x^2 + 78x + 44$

Chuck's – Bus by the Lake

$6x + 12$

$2x + 9$
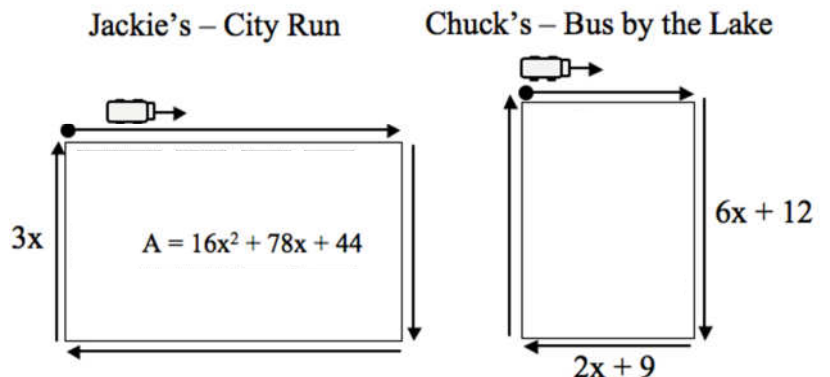
Note: the value of x here is not the same as that in challenge 1.

Charity Donation Amount

Once a "Champion" is determined, a donation is made on his behalf to the charity of his choice.

To calculate that amount, the judges consider the difference in the finish times, and multiply that by 1.2×10^3.

Your task is to calculate how long it takes for the contestants to complete each challenge in seconds, determine who will be crowned "Champion!", and how much his charity will receive.

* Please note that: $speed = \frac{distance}{time}$

Challenge	Jackie Chan (time in sec)	Chuck Norris (time in sec)
1		
2		
3		
4		
Total		

The Champion is _____ and the charity receives $_____.

Challenge 1- The Race of Champions

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Jackie

Find the length of the hill

A: $\quad c = \dfrac{\pi d}{2} = \dfrac{\pi(6.366m)}{2} = 10 \ m$

Find the length of the pit

$c^2 = a^2 + b^2$

B: $\quad = (4m)^2 + (3m)^2$

$= 25m^2$

$= 5m$

Find the length of the wall

C: $\dfrac{16x^5 y^2}{4x^4 y^2} = 4x$

Find total distance

d = 2x + A + 5x + B + 3x + C + 6x + 5

d = 2x + 10 + 5x + 10 + 3x +4x + 6x +5

d = 20x + 25

d= 20(6) +25

= 145 m

Find Jackie's time

$145\,m \div 1.25 m/s = 116 \sec onds$

Jackie's time is 116 seconds

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Chuck

Find the rate of change

$a = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{100 - 0}{90 - 10} = \dfrac{100}{80} = \dfrac{5}{4} = 1.25$

Find the initial value

$y = ax + b$

$b = y - ax$

$= (0) - (1.25)(10)$

$b = -12.5$

Find Chuck's time

y = 1.25x -12.5

$145 = 1.25x - 12.5$

$\underline{+12.5 \qquad\qquad +12.5}$

$\dfrac{157.5}{1.25} = \dfrac{1.25x}{1.25}$

$x = 126 \sec onds$

Or:
since speed is the same for both; just add 10 sec. (wasted time as start) to Jackie's time

Chuck's time is 126 seconds

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Challenge 2- Flying into the Stratosphere

Jackie	Chuck
Let y represent elevation in m Let x represent time in seconds $Y_J = 19x + 345$	Find the ROC of Chuck's ascent $a = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{876 - 660}{18} = 12m/s$ $Y_C = 12x + 660$

Jackie and Chuck

$y_J = y_C$

$19x + 345 = 12x + 660$

$\underline{-12x \qquad -12x}$

$7x + 345 = 660$

$\underline{-345 \quad -345}$

$\dfrac{7x}{7} = \dfrac{315}{7}$

X = 45 seconds

Find y and validate

$y_1 = 19x + 345$

$= 19(45) + 345$

$= 855 + 345$

$= 1200$

$y_2 = 12x + 660$

$= 12(45) + 660$

$= 540 + 660$

$= 1200$

Therefore

$(45,1200)$ is the solution

Therefore the time for both Jackie and Chuck is 45 seconds.

They both reach an elevation of 1200 m at this time.

Challenge 3- Zip-lining Down to Safety

Jackie	Chuck
Find the length of Jackie's path $c^2 = 1200^2 + 500^2$ $\quad = 1\,690\,000 m^2$ $c = 1300\,m$ Find the time $1300\,m \div 20m/s = 65\sec onds$ Jackie's time is 65 seconds	Find the length of Chuck's path $c^2 = 3500^2 + 1200^2$ $\quad = 13\,690\,000 m^2$ $c = 3700\,m$ Find the time $3700\,m \div 74m/s = 50\sec onds$ Chuck's time is 50 seconds

Challenge 4- The Feat of Strength

Find A_2 for Chuck

$A_2 = (2x+9)(6x+12)$

$\quad = 12x^2 + 24x + 54x + 108$

$\quad = 12x^2 + 78x + 108$

Let $A_1=A_2$ since same areas

$16x^2 + 78x + 44 = 12x^2 + 78x + 108$

$\quad 16x^2 + 44 = 12x^2 + 108$

$\quad\quad 4x^2 + 44 = 108$

$\quad\quad\quad 4x^2 = 64$

$\quad\quad\quad x^2 = 16$

$\quad\quad\quad x = 4$

Jackie

Length of Jackie's course

$A_1 = 12x^2 + 78x + 108$

$\quad = 12(4)^2 + 78(4) + 108$

$\quad = 612\, m^2$

Find the length

$l = \dfrac{A}{w} = \dfrac{612}{3x}$

$\quad = \dfrac{612}{3(4)} = \dfrac{612}{12} = 51$

Find the perimeter

$P = 2l + 2w$

$\quad = 2(51) + 2(12)$

$\quad = 102 + 24$

$\quad = 126\ m$

Find Jackie's time

$126\, m \div 5.25 m/s = 24 \sec$

Jackie's time is 24 seconds

Chuck

Perimeter for Chuck

$P = 2l + 2w$

$\quad = 2(2x+9) + 2(6x+12)$

$\quad = 4x + 18 + 12x + 24$

$\quad = 16x + 42$

$\quad = 16(4) + 42$

$\quad = 106\, m$

Find Chuck's time

$106\, m \div 2m/s = 53 \sec onds$

Chuck's time is 53 seconds

Charity Donation Amount

Difference in seconds = 274-250 = 24 seconds

Donation amount = $(24)(1.2 \times 10^3)$

= $ 28800

Challenge	Jackie Chan (time in sec)	Chuck Norris (time in sec)
1	116	126
2	45	45
3	65	50
4	24	53
Total	250	274

The Champion is __**Jackie Chan**__and the charity receives: $____**28 800**____ .