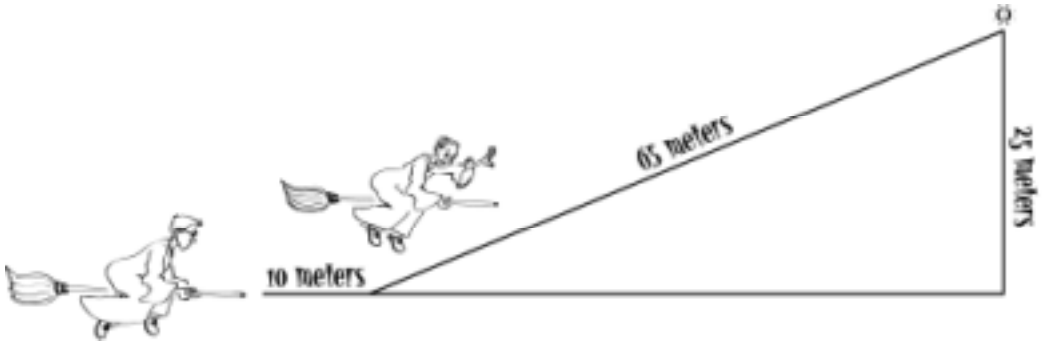
Hogwarts Express Problem Solving Set

1. Draco has taken Nevil's remembrall, jumped on his broom, and is in the air. A split second later, Harry is on his tail. Draco throws the remembrall into the air at an angle a bit less than 23°. At that same moment, Harry takes off from 10 meters behind Draco, flying in a straight path. The remembrall travels 65 meters, and then drops 25 meters straight down into Harry's waiting hand. How far did Harry travel?



2. Professor McGonagall was watching this scene from a window in the castle. She noted that Harry's mad dash after the remembrall took only 4 seconds. What was Harry's speed?

3. Convert Harry's speed to miles per hour. (Hint: There are about 1609 meters in one mile.)

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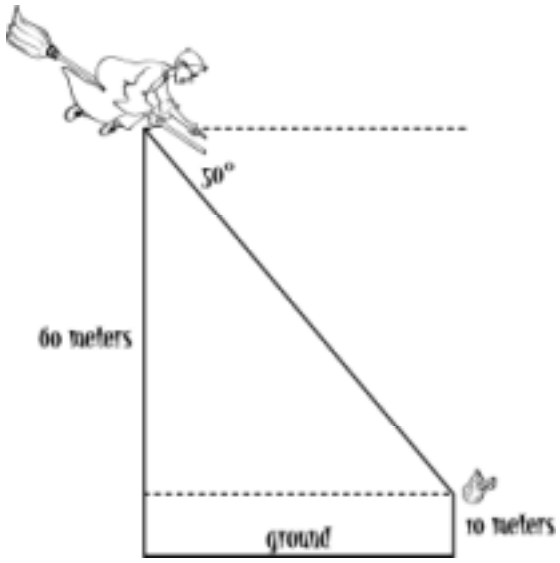
4. After this event, Harry becomes the youngest seeker to ever play on a Hogwarts Quiddich team. Professor McGonagall presents Harry with a brand new Nimbus 2000 broom. This new broom increases Harry's average speed by 25%. Use your answer from the previous problems to determine Harry's average speed on the Nimbus 2000 in both meters per second and miles per hour.

5. On the day of Harry's first Quiddich match, the seven-member team gathers in the locker room for the captain's pep talk. When Wood finishes his speech, each team member shakes hands with every other team member. How many handshakes occur?

6. Harry is very nervous as he walks onto the Quiddich playing field. As he looks around, he quickly estimates that about 2,500 fans fill the stands. What is the difference between the largest and smallest number of fans represented by this estimate?

7. Ten minutes into the game, Harry spots the snitch. Harry is 60 meters above the ground, and sights the snitch at a 50° angle about 10 meters above the ground. How far must Harry travel to reach the snitch?



8. Using Harry's average speed on his Nimbus 2000, determine how many seconds it will take him to reach the snitch.

9. After winning the match, Professor McGonagall rewards her house with 100 chocolate frogs. Each chocolate comes with a wizard card showing Professor Dumbledor, Professor McGonagall, Professor Quirrel, Hagrid, or Harry Potter. There are five more cards showing Professor Dumbledore than Professor McGonagall. One-fifth of the cards contain Professor Quirrel's picture. Harry appears on only one-sixth as many cards as Professor McGonagall. Hagrid is on twice as many cards as Harry. How many cards contain Professor McGonagall's picture?

10. Use the information from the previous problem to determine the probability of selecting a chocolate frog with a Harry Potter card?

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Sollutions:

1. Pythagorean Theorem

$x^2 + 25^2 = 65^2$

$x = 60$

60 + 10 = 70

Harry travels 70 meters

2. D = **rt**

r = 70 ÷ 4

r = 17.5

Harry's speed is 17.5 meters per second.

3. Unit Conversion

$$\frac{17.5\text{meters}}{1\text{second}} \times \frac{1\text{mile}}{1609\text{meters}} \times \frac{3600\text{seconds}}{1\text{hour}}$$

Harry's speed is about 39 miles per hour.

4. Percentage

17.5 meters/second x 1.25 ≈ 22 meters per second

39 miles / hours x 1.25 ≈ 49 miles per hour

5. Patterns:

People	Handshakes
2	1
3	3
4	6
5	10
6	15
7	21

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6. Rounding

The greatest number that rounds to 2,500 is 2,549.
The least number that rounds to 2,500 is 2,450.
2,549 2,450 = 99
The difference is 99.

7. Trigonometric Ratio

$$\sin 50^\circ = \frac{50}{x} \qquad \text{or} \qquad \cos 40^\circ = \frac{50}{x}$$

$$x = 50 \div \sin 50^\circ \qquad\qquad x = 50 \div \cos 40^\circ$$

About 65 meters About 65 meters

8. D = rt

$65 = 22t$

$t = \frac{65}{22}$

About 3 seconds

9. Algebraic Equation

Let x represent the number of Professor McGonagall cards
$x + 5$ represents the number of Professor Dumbledor cards
$\frac{1}{5} \times 100 = 20$, the number of Professor Quirrel cards
$\frac{1}{6}x$ represent the number of Harry Potter cards
$2 \times \frac{1}{6}x$ represents the number of Hagrid cards

$$100 = x + (x + 5) + 20 + (\frac{1}{6}x) + (\frac{2}{6}x)$$

$x = 30$

There are 30 Professor McGonagall cards.

10. Probability

There are 5 Harry Potter cards $(\frac{1}{6} \times 30 = 5)$

$\frac{5}{100}$ or $\frac{1}{20}$ or 5%

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