1 C

2 C

3 The probability is 0.607.

Accept an answer in [0.60, 0.61].

4 D

5 D

6 D

7 Example of an appropriate method

Let x: the number of \$20 bills in the bag

The number of bills in the bag

ten \$5 bills, four \$10 bills, x \$20 bills, one \$50 bill

There are $(15 + x)$ bills in the bag.

Expectation

$$\frac{10}{15+x}(-10) + \frac{4}{15+x}(-5) + \frac{x}{15+x}(5) + \frac{1}{15+x}(35) = 0$$

$$\frac{-100 + -20 + 5x + 35}{15 + x} = 0$$

$$\frac{-85 + 5x}{15 + x} = 0$$

$-85 + 5x = 0$

$x = 17$

Answer There are seventeen \$20 bills in the bag.

8 D

9 D

10 Example of an appropriate method

Probability that the marble will land in the rectangle

$$\frac{\text{area of the rectangle}}{400} = \frac{20 \times 10}{400} = \frac{200}{400} = \frac{1}{2}$$

Probability that the marble will land in the small square

$$\frac{\text{area of the small square}}{400} = \frac{10 \times 10}{400} = \frac{100}{400} = \frac{1}{4}$$

Probability that the marble will land in a triangle

$$\frac{\text{area of a triangle}}{400} = \frac{\frac{10 \times 10}{2}}{400} = \frac{50}{400} = \frac{1}{8}$$

Amount a contestant must bet

Let x be the amount of money a contestant must bet.

Since the game is fair, expectation is equal to 0.

$$-x \times \frac{1}{2} + 5 \times \frac{1}{4} + 10 \times \frac{1}{8} + 20 \times \frac{1}{8} = 0$$

$$-\frac{x}{2} + \frac{5}{4} + \frac{10}{8} + \frac{20}{8} = 0$$

$$-\frac{x}{2} + 5 = 0$$

$x = 0$

Answer A contestant must bet $10.

Note Students who correctly determine the probability for each section of the box have shown that they have a partial understanding of the problem.

To determine the probabilities, students can subdivide the bottom of the box into eight isometric triangles instead of calculating the areas of the different sections.

11 A

12 B

13 A

14 C

15 Example of an appropriate method

Mathematical expectation

$$\frac{1}{6} \times 2 + \frac{2}{6} \times 1 + \frac{3}{6} \times -3 = \frac{-5}{6}$$

If the game is to be fair, the mathematical expectation must be equal to zero. The expectation must therefore be increased by $\frac{5}{6}$.

Description of a fair game

If you bet \$3, you can play a game that involves rolling a fair die.
If you roll a 6, you win \$7 and keep the \$3 you originally bet.
If you roll a 4 or a 5, you win \$1 and keep the \$3 you originally bet.
If you roll a 1, a 2 or a 3, you lose the \$3 you originally bet.

Note "Appropriate method" means that the student has given a description of a fair game.

16 C

17 A

18 The probability that the pointer will be pointing at the red sector when the wheel stops spinning is 0.3.

19 Example of an appropriate method

x: the amount contestants must bet

Since this game is fair, mathematical expectation is equal to zero.

$$\frac{6}{12}(-x)+\frac{3}{12}(4)+\frac{2}{12}(6)+\frac{1}{12}(12)=0$$

$$\frac{-1}{2}x+1+1+1=0$$

$$\frac{-1}{2}x+3=0$$

$$\frac{-1}{2}x=-3$$

$$x=6$$

Answer: Contestants must bet $6.

Note: Students who use an appropriate method in order to determine the probability of each event have shown that they have a partial understanding of the problem.

20 C

21 B

22 Example of an appropriate method

Probabilities associated with each event

Probability of drawing 2 black marbles: $\frac{3}{5} \times \frac{2}{4} = \frac{6}{20}$

Probability of drawing 2 marbles of different colours: $\frac{3}{5} \times \frac{2}{4} + \frac{2}{5} \times \frac{3}{4} = \frac{12}{20}$

Probability of drawing 2 red marbles: $\frac{2}{5} \times \frac{1}{4} = \frac{2}{20}$

Amount of money you must bet (x)

Since the game is fair, the expected value is equal to 0.

$$\frac{6}{20}(7) + \frac{2}{20}(15) + \frac{12}{20}(-x) = 0$$

$$\frac{72}{20} - \frac{12x}{20} = 0$$

$$\frac{72}{20} = \frac{12x}{20}$$

$$6 = x$$

Answer: Given all the information, you must bet $**6**.

Note: Students who use an appropriate method in order to determine the probability associated with each event have shown that they have a partial understanding of the problem.

23 Example of an appropriate method

Distribution of the young people in the camp

	Boys	Girls	Total
Francophone	③ 72		② 90
Anglophone	④ 42	18	① 60
Total	⑤ 114		150

① 40% of 150 = 60

② 150 – 60 = 90

③ 80% de 90 = 72

④ 60 – 18 = 42

⑤ 72 + 42 = 114

Probability that the person chosen will be a boy

$$\frac{\text{Number of boys}}{\text{Number of young people}}$$

$$\frac{114}{150} = \frac{19}{25} = 76\% = 0.76$$

Answer: The probability that the person chosen will be a boy is $\mathbf{\frac{114}{150}}$ or $\mathbf{\frac{19}{25}}$.

Note: Students who use an appropriate method in order to determine that there are 72 francophone boys have shown that they have a partial understanding of the problem.

24 The measure of angle CPD is **36**°.

25 Example of an appropriate method

Since this game is fair, mathematical expectation is equal to zero.

Let x represent the amount of money players win (in addition to keeping the money they bet) if a white box is located behind the open door.

$$\frac{3}{9}(-2) + \frac{4}{9}(0) + \frac{2}{9}(x) = 0$$

$$\frac{-6}{9} + 0 + \frac{2x}{9} = 0$$

$$\frac{2x}{9} = \frac{6}{9}$$

$$2x = 6$$

$$x = 3$$

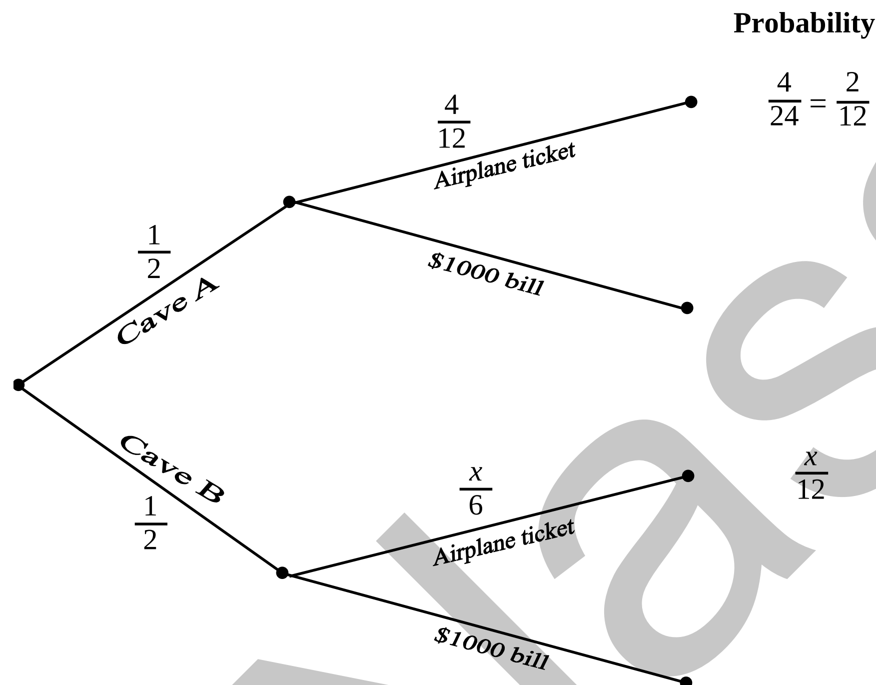
Answer: If a white box is located behind the open door, players win $**3** in addition to keeping the money they bet.

Note: Students who use an appropriate expression to represent mathematical expectation have shown that they have a partial understanding of the problem.

26 D

27 Example of an appropriate method

x : number of boxes in Cave B that contain an airplane ticket



Probability of winning an airplane ticket = $\frac{1}{2}$

$$\frac{2}{12} + \frac{x}{12} = \frac{1}{2}$$

$$\frac{2 + x}{12} = \frac{1}{2}$$

$$2 + x = 6$$

$$x = 4$$

Answer: **4** of the 6 boxes in Cave B contain an airplane ticket.

2

Sophie has to take two exams. She estimates that she has a $\frac{1}{3}$ chance of passing the first exam and a $\frac{3}{5}$ chance of passing the second exam.

What is the probability of her passing only one exam?

A) $\frac{4}{15}$

B) $\frac{7}{15}$

C) $\frac{8}{15}$

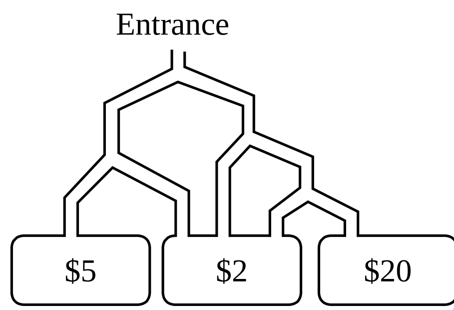
D) $\frac{11}{15}$

6 You can play four games of chance at a casino.

The Maze

You must bet $10.

You drop a marble into the maze shown on the right. You will win the amount indicated on the box in which the marble lands.

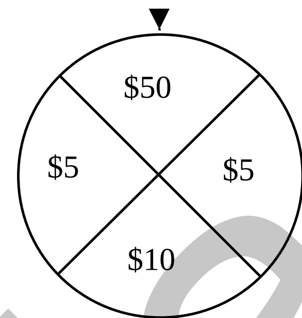


Wheel of Fortune

You must bet $20

You spin the wheel shown on the right.

The wheel will stop with the arrow pointing to one of the sectors. You will win the amount indicated on that sector.



The four sectors are congruent.

Heads or Tails

You must bet $15.

You toss an unweighted coin twice.

If the tosses result in "two heads" or "two tails", you win $20.

If the result of each toss is different, you win $5.

Dice

You must bet $15.

You roll two unloaded dice whose faces are numbered 1 to 6.

If the two dice show a sum equal to an even number, you win $20.

If the two dice show a sum equal to an odd number, you win $10.

Which of these four games is fair?

A) The Maze

B) Wheel of Fortune

C) Heads or Tails

D) Dice

7 A bag contains ten \$5 bills, four \$10 bills, one \$50 bill and a number of \$20 bills. If you bet \$15, you can draw a bill from the bag at random and keep it. The expected gain is zero.

How many \$20 bills are there in the bag?

Show all your work.

9 An amusement park features four games of dice. Each game involves rolling a fair die whose 6 faces are numbered 1 to 6. The following table outlines the rules of each game.

	If the number showing on the die is		
	less than 3	3	greater than 3
Game A	You lose $4	You break even	You win $4
Game B	You lose $4	You win $4	You win $4
Game C	You win $4	You break even	You lose $4
Game D	You win $4	You win $4	You lose $4

Which of these games is fair?

A) Game A

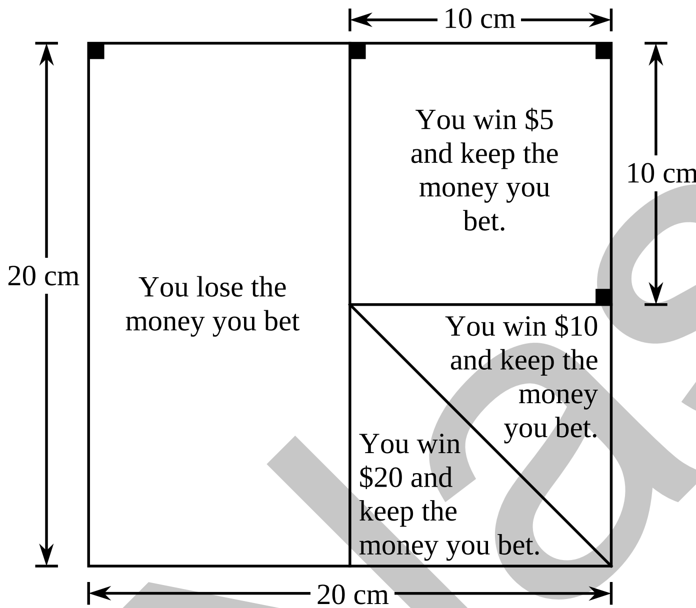
B) Game B

C) Game C

D) Game D

10 A game involves dropping a marble in a box with a square bottom whose sides measure 20 cm. To play this game, a contestant must bet a certain amount of money. A contestant will win or lose money depending on where the marble lands in the box.

The bottom of the box is illustrated below.



This game is fair.

How much money must a contestant bet?

Show all your work.

13 The following table provides information of the distribution of the 500 people working in a company.

	Men	**Women**	Total
Full-Time Workers			
Part-Time Workers		90	160
Total	280		500

One of these 500 people is chosen at random to take part in a survey on working conditions.

What is the probability that the person chosen will be a man working full time?

A) $\frac{21}{50}$

B) $\frac{14}{25}$

C) $\frac{17}{25}$

D) $\frac{14}{17}$

14 A bus that runs between two cities 100 km apart breaks down.

What is the probability that it was located a maximum of 10 km from either city when it broke down?

A) $\frac{1}{10}$

B) $\frac{1}{5}$

C) $\frac{4}{5}$

D) $\frac{9}{10}$

15 If you bet $3, you can play a game that involves rolling a fair die.

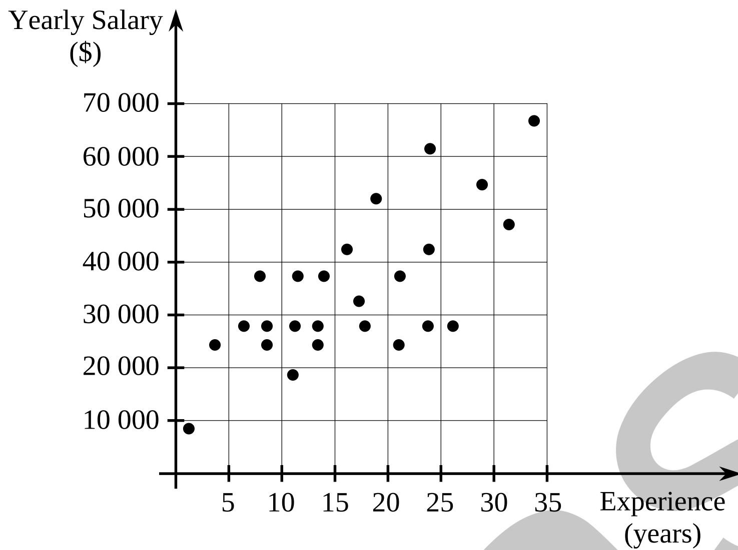
- If you roll a 6, you win $2 and keep the $3 you originally bet.
- If you roll a 4 or a 5, you win $1 and keep the $3 you originally bet.
- If you roll a 1, a 2 or a 3, you lose the $3 you originally bet.

This game is not fair.

Describe a way of making this game fair.

Show all your work.

17 The following scatter plot shows the yearly salary and number of years of experience of the 25 employees in a company.



One company employee is chosen at random.

What is the probability that the employee chosen will have fewer than 15 years of experience and make between $30 000 and $40 000 per year?

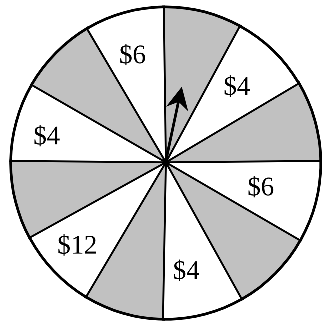
A) 0.12

B) 0.25

C) 0.3

D) 0.6

19 An amusement park offers a game of chance that involves spinning a pointer attached to the centre of a wheel divided into 12 congruent sectors.



If the pointer stops on a white sector, contestants win the amount of money indicated in the corresponding sector and keep the money they bet. If the pointer stops on a shaded sector, contestants lose the money they bet.

This game of chance is fair.

How much money must contestants bet?

Show all your work.

22 A game involves randomly drawing 2 marbles in succession from a bag containing 3 black marbles and 2 red marbles. The first marble you draw cannot be put back into the bag. Here are the rules of the game:

- If you draw two black marbles, you win $7 and keep the money you bet.
- If you draw two red marbles, you win $15 and keep the money you bet.
- If the two marbles you draw are not the same colour, you lose the money you bet.

This game is fair.

Given all the above information, how much money must you bet?

Show all your work.

23 There are 150 young people at a summer camp. Among the boys and girls at this camp, some are anglophones, and others are francophones.

- 18 anglophone girls are attending this camp.
- If one of these 150 young people is chosen at random, the probability that this person will be an anglophone is 40 %.
- If a francophone is chosen at random, the probability that this person will be a boy is 80%.

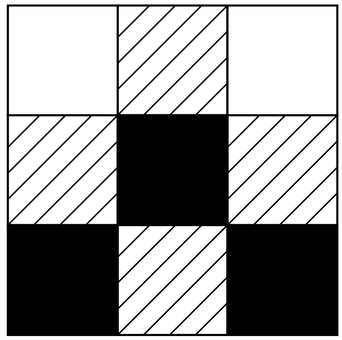
One of these 150 young people is chosen at random.

What is the probability that the person chosen will be a boy?

Show all your work.

25 A game of chance involves opening 1 of 9 identical doors on a panel.

Behind these doors are 3 black boxes, 4 shaded boxes and 2 white boxes.



Players must bet $2.

- If a black box is located behind the open door, players lose the money they bet.
- If a shaded box is located behind the open door, players keep the money they bet.
- If a white box is located behind the open door, players win a certain amount of money and keep the money they bet.

This game is fair.

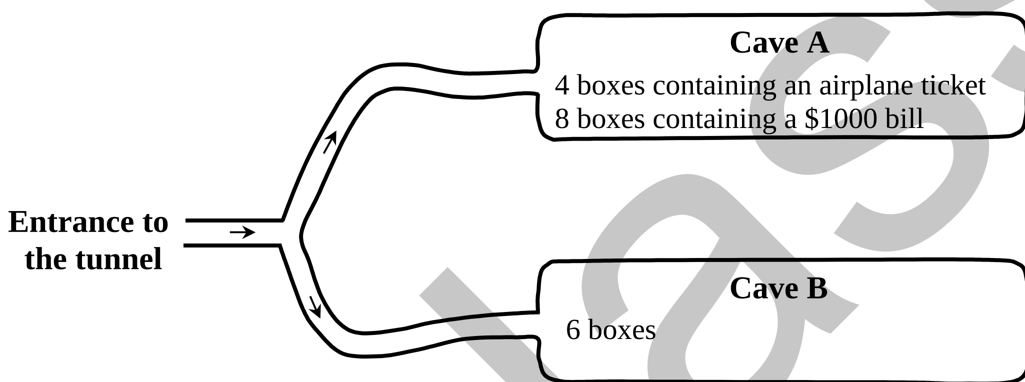
If a white box is located behind the open door, how much money do players win in addition to keeping the money they bet?

Show all your work.

27 Carl plays a game that involves looking for hidden treasures. He makes his way through a tunnel. When he gets to a point where the tunnel divides into two paths, he chooses one of them. He cannot retrace his steps.

When he gets to the end of the path he has chosen, Carl will enter a cave containing sealed boxes. Each box contains either an airplane ticket for a trip to Asia or a $1000 bill. Carl will choose one box at random, open it and find out what he has won.

The diagram below shows the tunnel and the caves as well as the contents of the boxes in Cave A.



The probability of winning an airplane ticket is equal to $\frac{1}{2}$.

How many of the 6 boxes in Cave B contain an airplane ticket?

Show all your work.