

# **Biomedical Admissions Test (BMAT)**

# Section 1: Thinking Skills Problem Solving Questions

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# **Problem Solving - Question by Topic**

(Mark Scheme and explanations at the end)

1 Two trains leave the station for london, train A at 9:00am and train B one minute after. Train A travels at 100 mph, and stops for a break for 25 minutes. Train B travels at 120 mph, and stops for a break for 35 minutes. The distance to london is 240 miles

Which train reaches London first, and by how many minutes?

- A Train A, by 13 minutes
- **B** Train A, by 14 minutes
- C Train B, 13 minutes
- **D** Train B, by 14 minutes
- **E** Train B, by 15 minutes
- **2** A car wash product A to shine the car is 60% liquid X, 30% water and 10% liquid Y. A car wash product B to shine the car is 50% liquid, 35% water and 15% liquid Y.

When 5 litres of product A and 4 litres of product B are added together what percentage of the total amount is water?

- **A** 30%
- **B** 30.2%
- **C** 32.2%%
- **D** 35%
- **E** 35.2%

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3 An automatic grass cutter machine cuts grass at a constant rate. Garden A has a circular fountain in the middle surrounded by grass, the grass cutter cuts the grass in garden A in 36 minutes. The circular fountain in the middle of garden A has an area of 15m squared



How long would it take the grass cutter to cut the grass in garden B, which has a fountain that is % of the area covered by the fountain in garden A?

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- Α 180 minutes
- В 192 minutes
- С 240 minutes
- D 252 minutes
- E 300 minutes





4 A company has a number of employees, 15% of them are IT consultants. The company hires 90 more workers. Enough IT consultants join so that the percentage of IT consultants at the company is now 20%. The total number of IT consultants in the company now is 90

What was the original number of workers in the company before 90 more workers joined?

A 300
B 350
C 360
D 380
E 450

**5** Josh, Rose and Ivy play chess. They all start off with 3 marbles of different colours, the winner of each chess game gets one marble of their own colour to the winner.

Josh has 4 red marbles Rose has 5 blue marbles Ivy has 3 green marbles

Ivy won game 1 Josh won game 2 Rose won game 3

How many marbles of each colour does Josh have at the end?

A 3 red, 1 blue, 1 green
B 2 red, 2 blue, 1 green
C 1 red, 1 blue, 1 green
D 2 red, 1 blue, 1 green
E 1 red, 3 blue, 1 green

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6 A warehouse company placed a clothes order for 1000 tops, 1200 trousers and 800 skirts for £15,000. Each item of clothing was bought for the same price. Half of the amount of each item of clothing ordered was sold at a fixed price on day one

In order to get a 20% profit by how much more should they sell each item of clothing sold on day one?

- A £1
   B £5
   C £6
   D £7
   E £10
- 7 A group of kids set up a password for their club, the password was made up of a sequence of their names. No name beginning with the same letter or with the same number of letters in their name are next to each other. When you multiply the number of letters in the first and last name you get 6

Which of the options below is the correct password?

- A Jo, Laura, Ivy, Ian, Rose, James
- **B** Jo, James, Rose, Ivy, Laura, Ian
- **C** Ivy, Rose, James, Laura, Ian, Jo
- D Jo, Laura, Ivy, James, Ian, Laura
- E lan, Laura, Ivy, Rose, James, Jo
- A cookie recipe for 12 people consists of:
   200 grams of butter
   200 grams of sugar
   300 grams of flour
   4 eggs

How much of each ingredient would you need to make enough cookies for 27 people?

- A 450g butter, 400g sugar, 675g flour, 9 eggs
- **B** 450g butter, 450g sugar, 675g flour, 8 eggs
- **C** 450g butter, 450g sugar, 675g flour, 9 eggs
- **D** 400g butter, 400g sugar, 600g flour, 8 eggs
- **E** 450g butter, 450g sugar, 650g flour, 9 eggs





**9** A cake recipe requires 3 eggs, 150g of flour, 150g of full fat butter and 150g of sugar, which comes to 800 calories

Full fat butter has 200 calories in 100 grams Low fat butter has 160 calories in 100 grams

In order to reduce the calories contributed by the butter by 20% how much low fat butter must be used?

- A 50 grams
- **B** 80 grams
- **C** 87.5 grams
- **D** 100 grams
- E 150 grams
- **10** A company opens on the 1st January 2005 and has 10,000 employees. The company does well for the first 6 years and no employees leave. After this, due to the poor financial condition of the company, every 2 months 0.5% of the employees leave.

If this rate continues, what percentage of the original number of employees left by 1st July 2012?

- A 4.5%
  B 5%
  C 7%
  D 9%
- **E** 9.5%
- 11 In order to get to the temple you have to climb 240 steps. Ross can walk 10 steps in 20 seconds. Ruby can walk 12 steps in 30 seconds. Both Ross and Ruby start walking up the stairs at the same time. Ross takes a break halfway up for 15 minutes and Ruby takes a break halfway up for 10 minutes.

Who reaches the temple first, and how much quicker?

- A Ross, by 3 minutes
- B Ruby, by 3 minutes
- C Ross, by 4 minutes
- D Ruby, by 4 minutes
- E Ruby, by 5 minutes





12 There are two clocks in a room, clock A and clock B clock B is ahead of clock A. The time checked when it's 9:00 am on clock A and 9:18 am on clock B. When the time is checked on both clocks again 555 minutes have passed. Clock A broke down in between and is now 2.5 times as ahead of clock B than the number of minutes clock B was ahead of clock A.

What time is clock A showing now?

Α	6:15	pm
B	6.33	nm

- **B** 6:33 pm **C** 6:51 pm
- **D** 7:00 pm
- **E** 7:15 pm

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# **Answers and Explanations**

В

1

We need to make sure we keep in mind what the first line of the question says, it clearly mentions that train B leaves 1 minutes later than train A. So we know that train B leaves at 9:01 am.

In order to keep your workings clear so you don't get confused, you can work out the time it takes for each train to reach london one by one, using the equation  $S = D \div T$  (*Speed* = *Distance*  $\div$  *Time*).

First we will work out Train A:

Train A travels at a speed of **100 mph**, we know the distance to london **240 miles**, therefore:

$100 = 240 \div T$			2	12	4	
$100 - 240 \cdot 1$	x			6	0	
$100 \times T = 240$				0	0	
$T = 240 \div 100$			2			
T = 2.4 hours	+	1	4	4	0	
$T = 2.4 \times 60$	=	1	4	4	.0	
T = 144						
T = 2 hours and 24 minutes						

This means it takes Train A 2 hours and 24 minutes to reach London. However we need to remember to add on the 25 minutes train A stopped for a break. 2 hours 24 minutes + 25 minutes = 2 hours 49 minutesTherefore it takes Train A 2 hours and 49 minutes to reach london.

Train A leaves at 9:00 am which means it reaches London at 11:49 am. 9:00 am + 2 hours 49 minutes = 11:49 am

#### Now we will work out Train B:

Train B travels at a speed of 120 mph, and the distance to london is the same (240 miles) therefore:  $S = D \div T$   $120 = 240 \div T$   $120 \times T = 240$   $T = 240 \div 120$ T = 2 hours

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This means it takes train B 2 hours to get to London. However we need to take the break time into account which is 35 minutes, therefore train B takes 2 hours and 35 minutes to reach london.

2 hours + 35 minutes = 2 hours and 35 minutes

We need to remember that train B leaves at **9:01 am**, so train B reaches london at **11:36am**.

9 : 01 *am* + 2 *hours* 35 *minutes* = 11 : 36 *minutes* 

#### 2

С

We are told the **ratio** of different liquids and water that are used in order to make either car wash product A or B. However we need to remember that the question only asks about the **percentage of water**, so we need to concentrate on how much water is present in car washing product A and B.

#### **Product A:**

**5 litres** of product A is used, so we need to work out how much of this is water, we are told **30% in Product A is water**.

If you look at the answers you can see that they are in **ml** therefore you can either **convert the end answer** into ml or **convert it in the beginning** (here it is converted in the beginning):

We know that there are 1000 ml in 1 litre therefore:  $5 \times 1000 = 5000$ We now know that **5000 ml** of Product A is used.

Water in 5000 ml (5 litres) of Product A, we are told **30%** of product A is water:

 $(5000 \times 30) \div 100 = 1500 \ ml$ Therefore **1500 ml of water** is present in 5000 ml of product A.

# **Product B:**

We now need to work out the amount of **water** in **4 litres of Product B**. We know that there are 1000 ml in 1 litre therefore:

 $4 \times 1000 = 4000$ 





We now know that **4000 ml** of Product B is used. We are told that **35%** of Product B is water:  $(4000 \times 35) \div 100 = 1400 \text{ ml}$ Therefore **1400 ml of water** is present in 4000 ml of Product B.

We need to work out the **total percentage of water** when 5 litres of product and 4 litres of Product B are **mixed together**, therefore we need to find out the **total amount of water** when we have 9 litres of Product A and B together:

1500 + 1400 = 2900When 5000 ml of product A and 4000 ml of product B are mixed together the total amount of water present is **2900 ml**.

In order to find out the percentage of water present when 5000 ml of Product A and 4000 ml of Product B is mixed together, we need to know how much product we have in total:

5000 + 4000 = 9000Therefore we have **9000 ml** of product in total.

#### Percentage of water in 9000 ml of Product A and B:

 $2900 \div 9000 = 0.3222$ 

0.3222 × 100 = 32.22% 2900/9000) x 100 = 32.22%

Therefore when 5000 ml of product A and 4000 ml of product B are mixed together the total percentage of water present is **32.22%**.

2 2 2 9 0 0 0 2 29 290 2900 2900 0 0 1 8 0 0 0 





# 3 D

We are told that the grass cutter will cut the grass in Garden A in **36 minutes**. We are **not** told what the area of the Garden A or B is, however we can use the measurements given in the **diagram** to work this out.

We are told that the circular fountains area is **15m squared**, we must **subtract** this from the area of the rectangular garden in order to find out the area of the grass.

# Area of Garden A:

 $12 \times 11.75 = 141$ 

Therefore the area of Garden A is **141 m squared**.

	1	1		7	5
х				1	2
			1	1	
		2	3	5	0
+	1	1	7	5	0
		1	1		
=	1	4	1	.0	0

Area of grass in Garden A cut by grass cutter:

$$141 - 15 = 126$$

Therefore the area of the grass cut by the grass cutter in Garden A is **126 m squared**.

# Area of Garden B:

 $30 \times 29.8 = 894$ 

Therefore the area of garden B is **894 m squared**.

	2	9		8
x			3	0
		0	0	0
	2	2		
+	8	9	4	0
=	8	9	4	. 0

We are told that the area of the circular fountain in Garden B is **%** of the area of the area of the fountain in Garden A, which is **15m squared**. We need to multiply the area of the fountain in Garden A by 4/5 to find the area of the fountain in Garden B.

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# Area of the fountain in Garden B:

 $15 \times 4/5 = 12$ 

Therefore the area of the fountain in Garden B is **12 m squared**.



Next we need to find out the area of the grass in garden B that will be cut by the grass cutter

# Area of grass in garden B that needs to be cut by grass cutter:

894 - 12 = 882

Therefore the area of grass that needs to be cut by the grass cutter in garden B is **882 m** squared.

In order to work out how long it takes for the grass cutter to cut the grass in garden B we need to work out how many times bigger the area of the grass that needs to be cut in garden B is compared to garden A:

 $882 \div 126 = 7$ 

Therefore the area of grass that needs to be cut in garden B is **7 times bigger** than area of grass cut in garden A.

It takes the grass cutter **36 minutes** to cut the grass in garden A so it will take the grass cutter **7 times longer** to cut the grass in garden B, this is because the grass cutter cuts at a **constant** rate. Therefore:

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# $36 \times 7 = 252$

It takes **252 minutes** for the grass cutter to cut the grass in garden B.







#### 4

С

In order to work out the original number of workers **before** 90 more workers joined we can use an **algebraic equation**, where we take **X** to be the **original number of workers**.

We are told that once the 90 workers have joined **20%** of the total number of workers now are **IT consultants**. We are told that 20% of the total number of workers who are now IT consultants equals to 90 workers. Therefore we can form the equation:

$\frac{(X+90) \times 20}{100} = 90$			
$\frac{(X+90)\times 1}{5} = 90$		9	0
$X + 90 = 90 \times 5$	x	297.6	5
X + 90 = 450	4	5	0
X = 450 - 90			
<i>X</i> = 360			

Therefore the original number of workers is **360**.

#### 5

D

In order to work out this question it is important to clearly work out how many **marbles** each player has after each game. Remember each person has to give a marble of their colour, to the person who wins the game.

Ivy won the first game therefore Josh and Rose gave one marble each to Ivy. Therefore at the end of the game Josh has 3 red marbles, Rose 4 blue ones and Ivy has 3 green marbles, 1 blue and 1 red

**Josh** won the second game, therefore Rose and Ivy must give **one marble** of their colour to Josh.

At the end of the second game, Josh has 3 red, 1 blue and 1 green marbles, Rose has 3 blue marbles and lvy has 2 green, 1 blue and 1 red marbles.

Rose wins the third game, so Josh and Ivy must give one marble of their colour to Rose. At the end of the third game Josh has 2 red marbles, 1 red marble and 1 green marble. Rose has 3 blue marbles, 1 red marble and 1 green marble, and Ivy has 1 green, 1 red and 1 blue marble.





The question asks how many marbles Josh has at the **end of the three games**, we know that Josh has **lost 2 games** and **won 1**. Therefore he will **lose** two of his red marbles and he is given 1 green by Ivy and 1 blue by Rose.

Therefore Josh has 2 red marbles, 1 blue and 1 green at the end of the 3 games.

# 6 D

All of the items of clothing bought by the warehouse were all bought by the **same price**. And we are also told that only **half** of each type of clothing, this means **500 tops**, **600 trousers and 400 skirts**, were sold so that the warehouse made a **20% profit**.

We first need to find out the total price at which each piece of clothing was bought by the warehouse, as we are told the total cost of the order ( $\pounds$ 15000). We know that all the items of clothing were bought at the same price, so we can use x to be the price that each time of clothing was bought for.

1000.11200.1200.1 = 15000					0	5	0	0	0	
1000x + 1200x + 800x = 15000	3	0	0	0	1	<sub>1</sub> 5	0	0	0	
3000x = 15000					1	5	0	0	0	
$x = 15000 \div 3000$					0	0	0	0	0	
x = 5										

Therefore each item of clothing was bought for £5.

We need to find out how much money the warehouse will need to make in order to make a **20% profit**, we need to **add** this 20% profit on to the total cost of the order £15000.

 $15000 \times 1.20 = 18000$ 

The warehouse needs to make £18000.

We can work out the cost at which each item of clothing needs to be sold by **dividing £18000 by the number of clothing items sold on day one** (remember this is half the amount of each item of clothing bought).

1000 tops were bought, therefore 500 tops will be sold on day one.
1200 trousers were bought, therefore 600 trousers will be sold on day one.
800 skirts were bought, therefore 400 skirts will be sold on day.

```
500x + 600x + 400x = 18000

1500x = 18000

x = 18000 \div 1500

x = 12

Therefore each item of clothing must be sold for £12, to make a 20% profit.
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Be careful as the question does not ask how much each item of clothing is sold for but **how much more** is it sold for than the amount each item of clothing was bought for. Therefore we need to subtract the cost at which each item of clothing is bought for ( $\pounds$ 5) from the cost that it's sold for ( $\pounds$ 12).

#### 12 - 5 = 7

Therefore each item of clothing is sold for  $\pounds7$  more.

# 7 D

- A is wrong. This is because the question states that the password **does not** have two names together that begin with the same letter. In option A the names **lvy and lan** are next to each other, they both begin with I. The question also states that two names that are next to each other do not have the same number of letters in their name, lvy and lan **both have 3 letters**.
- B is wrong. This is because Jo and James are next to each other and both begin with J In this option one of the rules which is that the number of letters in the first and last names multiplied together gives 6, as Jo has 2 letters and Ian has 3, when multiplied together this gives 6.
- **C** is wrong. This is because, although when the number of letters in the first and last names are multiplied together you get 6, the names Laura and James are next to each other and they both have **5** letters in their names.
- **D** is wrong. This is because the number of letters multiplied in the first and last name multiplied together **do not equal 6.** As Laura has 5 letters and Jo 2, when you multiply these together you get 10, not 6.

*Exam Tip* - The option must fulfill **all the rules** in the question, therefore be careful if you find one rule that fits, this does not mean that option is the right answer as **another rule may not be followed** by the option.

For example in option B, one of the rules which is that the number of letters in the first and last name must multiply together to give 6, this rule works in option B. However another rule is that people whose names begin with the same letter must not sit next to each other however Jo and James sit next to each other and both their names begin with J.

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#### 8 D

The cookie recipe ingredients given are for **12 people** however we are told to find out how much is needed for **27 people**.

We need to find out how many grams of each ingredient is needed to make enough cookies for 27 people. In order to do this first we need to work out how many times more 27 people are compared to 12 people.

#### $27 \div 12 = 2.25$

Therefore 27 people are **2.25 times** as many people as 12.

To work out how much of each ingredient is needed to make neough cookies for 27 people we need to multiply the amount of each ingredient by 2.25.

#### Butter

 $200 \times 2.25 = 450$ Therefore **450 grams** of butter is needed.

# Sugar

 $200 \times 2.25 = 450$ Therefore **450 grams** of sugar is needed.

# Flour

 $300 \times 2.25 = 675$ Therefore **675 grams** of flour is needed.

# Eggs

 $4 \times 2.25 = 9$ Therefore **9 eggs** are needed.

*Exam Tip* - With these sort of questions it is important to know exactly how many times more you need as this will form the basis of your workings.

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### 9 C

We are told that the total number of calories in the cake are **800**, we need to find out how many calories should be in the cake if there are **20% less calories**, this gives us:

 $800 \times 0.8 = 640$ Therefore the cake should have 640 calories.

We must also find out how many less calories we need

800 - 640 = 160Therefore the cake should have **160** calories less.

The question asks us to find out how much **low fat butter** should be used to reduce the calories contributed by the butter by **20%**.

We need to find out how many calories are contributed by the **full fat butter** to work out how much is 20% less. Therefore we need to find the **total number of calories** in the full fat butter when 150 grams are used in the recipe.

We are told that there are 200 calories in 100 grams. 100 grams = 200 calories

# Calories in 150 grams of full fat butter:

 $200 \times 1.5 = 300$ Therefore 150 grams of full fat butter will have **300 calories**.

The question asks **how much less low fat butter** should be used in comparison to full fat butter. We need to subtract 160 calories from 300 calories to find out **how many calories of low fat butter we need** to make sure the whole cake has 20% less calories.

300 - 160 = 140Therefore the low fat butter used should have **140** calories in total.

We know need to find out how many grams of low fat butter will have 140 calories in total.

We are told that **100 grams** of low fat butter has **160 calories**. 100 grams = 160 calories

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140 calories is **0.875** of 160 calories as:



 $140 \div 160 = 0.875$ 

We know that 100 grams is 160 therefore grams of low fat butter needed to have 140 calories in total:

 $100 \times 0.875 = 87.5$ 

**87.5 grams** of low fat butter are needed to make sure there are 20% less calories in the cake.

#### 10

Α

We are told that the company originally had **10000 employees** and **after 6 years every 2 months 0.5% left**. The question asks us how many employees have left altogether by the **1st July 2012**.

It is important to remember that for the **first six years no employee left**, so till the **1st January 2010** no employee left as: 1st January 2005 + 5 years = 1st January 2011

Therefore we need to find out how many months are between the 1st January 2011 and the 1st July 2012.

1st July 2012 - 1st January 2011 = 18 monthsThis comes to **18 months**, make sure you **do not count July as a month** as the whole of June is required but **not July**.

We need to find out how many employees leave every 2 months, we are told **0.5%** of the total number of employees leave every 2 months:

 $10000 \times 0.5 = 5000$  $5000 \div 100 = 50$ Therefore **50 employees** leave the company every **2 months**.

We need to find out how many employees leave in **18 months** if **50 leave every 2** months.

We need to work out how many 2 months are in 18 months:  $18 \div 2 = 9$ 

We multiply the number of employees that leave every two months (50) by 9.





#### $50 \times 9 = 450$

Therefore **450** employees leave in total from the 1st January 2011 to the 1st July 2012.

The question asks for the **percentage of the original number of employees that have left.** We need to find out what **percentage** of 10000 is 450:

 $450 \div 10000 = 0.045$  $0.045 \times 100 = 4.5\%$ Therefore **4.5%** of t

Therefore **4.5%** of the original number of employees have left from 1st January 2011 to 1st July 2012.

# 11 B

We need to work out how long both Ross and Ruby take to reach the temple separately and then work out the difference to see who reaches it quickest and by how much. We will work out how long each of them take separately.

#### Ross:

Ross takes **10 steps in 20 seconds**. There are a total of **240 steps**. We need to find out how many **10 steps are in 240**:  $240 \div 10 = 24$ 

We now need to work out how long it will take Ross to climb the stairs to the temple:  $24 \times 20 = 480$ 

Therefore Ross takes **480 seconds** to climb 240 steps.

The answer options are in minutes so we need to **convert the seconds Ross took to climb the steps to minutes**. We know there are 60 seconds in one minute:  $480 \div 60 = 8$ Therefore it takes Ross 8 minutes in total to climb the steps.

Ross takes a **15 minute break**, we need to add this onto the 8 minutes that Ross takes to go up the steps: 8 + 15 = 23

Therefore it takes Ross a total of **23 minutes** to reach the temple.





# Ruby:

Ruby takes **12 steps in 30 seconds**. There are a total of **240 steps**.

We need to find out how many **12 steps are in 240**:  $240 \div 12 = 20$ 

We now need to work out how long it will take Ross to climb the stairs to the temple:  $20 \times 30 = 600$ Therefore Ruby takes **600 seconds** to climb the steps.

The answer options are in minutes so we need to **convert the seconds Ruby took to climb the steps to minutes**, We know there are 60 seconds in one minute:  $600 \div 60 = 10$ 

Therefore Ruby takes **10** minutes in total to go up the steps.

Ruby takes a **10 minute break**, we need to add this onto the 10 minutes that Ruby takes to go up the steps:

10 + 10 = 20

Therefore it takes Ruby a total of **20** minutes to reach the temple.

The question asks us who reaches the temple first and how much faster.

We can tell that **Ruby takes less time** to reach the temple and therefore reaches the temple first. We need to subtract the time Ruby takes to reach the temple (**20 minutes**) from the time Ross takes (**23 minutes**) to find out how much earlier Ruby will reach the temple compared to Ross:

23 - 20 = 3

Therefore Ruby reaches the temple first by 3 minutes.

# 12 D

In this question it is important to remember that **initially clock B is ahead of clock A**, but at the end we are told that **clock A breaks down** and is now **2.5 times** as ahead of clock B than clock B was ahead of clock A initially.

Initially clock B is **18 minutes ahead** to clock A. We need to multiply the amount of time initially clock B was ahead of clock A **(18 minutes)** by **2.5** to find out how many times ahead clock A is of clock B after it broke down:

 $18 \times 2.5 = 45$ 





Therefore clock A is now 45 minutes ahead of clock B.

The question tells us **555 minutes** have passed when the time is checked again. We need to convert this time into hours and minutes so it is easier to add on. We know there are 60 minutes in one hour.

 $555 \div 60 = 9.25$   $0.25 \times 60 = 15$  9.25 hours = 9 hours and 15 minutesTherefore 9 hours and 15 minutes have passed when the time is checked again.

Clock A is first checked at 9 am, we need to add 9 hours and 15 minutes: 9 : 00 am + 9 hours 15 minutes = 6 : 15 pm

However as clock A broke down and is now 45 minutes ahead of clock B, we need to add an extra 45 minutes to clock A: 6:15 pm + 45 minutes = 7:00 pm

Clock B is first checked at 9:18am, we need to add 9 hours and 15 minutes: 9 : 18 pm + 45 minutes = 6 : 33 pm



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