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GMAT & GRE QUANT CORE

Problem Solving *Practice Set 1*

Twenty exam-style questions, alternating GRE and GMAT, on number properties, percents, algebra, statistics and rates. Each comes with a step-by-step solution, the trap to avoid and a faster route.

GRE | GMAT | 20 QUESTIONS | FULL SOLUTIONS

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BEFORE YOU BEGIN

How to use this set

Every question is labelled with the exam it comes from. The set alternates: a GRE question, then a GMAT question, and so on. Work all twenty, or drill only the odd numbers for GRE or the even numbers for GMAT.

1

Time yourself

Allow 40 minutes for all twenty: about 1¾ minutes per GRE question and 2 minutes per GMAT question, the pace of each real exam.

2

Mark your answers

Use the work space on each page, then record your choice on the answer sheet after Question 20.

3

Score yourself

Check the answer key. Circle every miss and every lucky guess.

4

Study the solutions

Read the trap and the faster route for each question, even the ones you got right.

WHAT THIS SET COVERS

Question map

Odd numbers are GRE questions; even numbers are GMAT questions.

#	EXAM	TOPIC	SKILL TESTED
1	GRE	Number Properties · Last Digits	Last two digits of a product
2	GMAT	Rates · Linear Change	Heights burning at constant rates
3	GRE	Number Properties · Odd & Even	Must-be-even expressions
4	GMAT	Word Problems · Break-even	Set two cost models equal
5	GRE	Exponents · Inequalities	Powers of 2 benchmark
6	GMAT	Percents · Powers of 10	Percent of a whole
7	GRE	Algebra · Inverse Variation	Constant product
8	GMAT	Number Properties · Divisibility	Prime factors of a power
9	GRE	Percents · Successive Changes	Multiplier method
10	GMAT	Number Properties · Unit Fractions	Bounding integer solutions
11	GRE	Word Problems · Fractions	Part-to-whole
12	GMAT	Percents · Nested Groups	Percent of a remainder
13	GRE	Statistics · Weighted Average	Combine group totals
14	GMAT	Algebra · Integer Solutions	Sum of squares
15	GRE	Statistics · Extreme Values	Minimize one term
16	GMAT	Percents · Part of a Part	Reverse percent
17	GRE	Counting · Algebraic Expressions	Remove a row and a column
18	GMAT	Statistics · Range	Constructing a data set
19	GRE	Rates · Unit Conversion	Estimate with powers of 10
20	GMAT	Algebra · Quadratics	Substitute for a radical

QUESTION

01

GRE

Number Properties · Last Digits

Target time · 1:45

If x and y are the tens digit and the units digit, respectively, of the product $725{,}278 \times 67{,}066$, what is the value of $x + y$?

A 12

B 10

C 8

D 6

E 4

WORK SPACE

QUESTION

02

GMAT

Rates · Linear Change

Target time · 2:00

Candle A and Candle B have equal heights but different volumes. While the candles are burning, the height of each candle decreases at its own individual constant rate, with Candle A taking a total of t minutes to completely burn down and Candle B taking a total of $2t$ minutes to completely burn down. If both candles begin burning at the same time, in terms of t, how many minutes will it take for Candle B's height to be twice Candle A's height?

A $\frac{1}{4}t$

B $\frac{1}{3}t$

C $\frac{2}{3}t$

D $\frac{3}{4}t$

E t

WORK SPACE

QUESTION

03

GRE

Number Properties · Odd & Even

Target time · 1:45

If x is an integer, which of the following must be an even integer?

(A) $x^2 - x - 1$

(B) $x^2 - 4x + 6$

(C) $x^2 - 5x + 5$

(D) $x^2 + 3x + 8$

(E) $x^2 + 2x + 10$

WORK SPACE

QUESTION

04

GMAT

Word Problems · Break-even

Target time · 2:00

For the rental of a certain type of car, Rental Agency R charges a fee of $30 per day plus a fee of $0.20 for each mile traveled in excess of 100 miles per day. For the rental of the same type of car, Rental Agency S charges a fee of $65 per day with free unlimited mileage. If a car of this type is to be rented for 3 days and will be driven the same number of miles each day, for what total number of miles will the cost of renting the car from Rental Agency R be the same as the cost of renting the car from Rental Agency S?

A 352

B 405

C 525

D 750

E 825

WORK SPACE

QUESTION

05

GRE

Exponents · Inequalities

Target time · 1:45

What is the least integer n such that $\frac{1}{2^n} < 0.001$?

A 10

B 11

C 500

D 501

E There is no such least integer.

WORK SPACE

QUESTION

06

GMAT

Percents · Powers of 10

Target time · 2:00

State X has 77 acres designated as wilderness, which is 0.0003 percent of its total acreage. Which of the following expresses the total acreage of State X ?

A $3(10^4)(77)$

B $3(10^6)(77)$

C $\frac{(10^2)(77)}{3}$

D $\frac{(10^4)(77)}{3}$

E $\frac{(10^6)(77)}{3}$

WORK SPACE

QUESTION

07

GRE

Algebra · Inverse Variation

Target time · 1:45

The quantities S and T are positive and are related by the equation $S = \frac{k}{T}$, where k is a constant. If the value of S increases by 50 percent, then the value of T decreases by what percent?

A 25%

B $33\frac{1}{3}\%$

C 50%

D $66\frac{2}{3}\%$

E 75%

WORK SPACE

QUESTION

08

GMAT

Number Properties · Divisibility

Target time · 2:00

When the integer k^4 is divided by 32, the remainder is 0. Which of the following could be the remainder when the integer k is divided by 32 ?

I. 2

II. 4

III. 6

(A) None

(B) I only

(C) II only

(D) I and II

(E) II and III

WORK SPACE

QUESTION

09

GRE

Percents · Successive Changes

Target time · 1:45

A car manufacturer produced a car at a cost of d dollars and sold it to a dealer at a price 20 percent higher than the production cost. If the dealer sold the car to a consumer for 15 percent more than the dealer paid for it, what did the car cost the consumer, in dollars?

A $1.05d$

B $1.23d$

C $1.30d$

D $1.35d$

E $1.38d$

WORK SPACE

QUESTION

10

GMAT

Number Properties · Unit Fractions

Target time · 2:00

If x, y, and z are positive integers such that $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$, which of the following could be the value of $x + y + z$?

I. 7

II. 9

III. 11

(A) I only

(B) II only

(C) III only

(D) I and II

(E) II and III

WORK SPACE

QUESTION

11

GRE

Word Problems · Fractions

Target time · 1:45

A developer has land that has x feet of lake frontage. The land is to be subdivided into lots, each of which is to have either 80 feet or 100 feet of lake frontage. If $\frac{1}{9}$ of the lots are to have 80 feet of frontage each and the remaining 40 lots are to have 100 feet of frontage each, what is the value of x?

A) 400

B) 3,200

C) 3,700

D) 4,400

E) 4,760

WORK SPACE

QUESTION

12

GMAT

Percents · Nested Groups

Target time · 2:00

During a certain year, 80 percent of the visitors to the Smithsonian Institution were United States citizens, 50 percent of the remaining visitors were Canadian or Mexican citizens, and 50 percent of the visitors who were not citizens of the United States, Canada, or Mexico were citizens of European countries. The number of United States citizens who visited the Smithsonian that year was approximately how many times the number of citizens of European countries who visited the Smithsonian that year?

A 1.6

B 4.8

C 8

D 16

E 32

WORK SPACE

QUESTION

13

GRE

Statistics · Weighted Average

Target time · 1:45

A tailor used 30 buttons that had an average (arithmetic mean) weight of x grams per button and 20 other buttons that had an average weight of 80 grams per button. Which of the following is the average weight per button, in grams, of the 50 buttons that the tailor used?

(A) $\frac{x + (20)(80)}{50}$

(B) $\frac{x + 80}{50}$

(C) $\frac{3}{5}x + \frac{8}{5}$

(D) $\frac{3}{5}x + 32$

(E) $\frac{5}{8}x$

WORK SPACE

QUESTION

14

GMAT

Algebra · Integer Solutions

Target time · 2:00

If x and y are integers and if $(x - y)^2 + 2y^2 = 27$, which of the following could be the value of x?

A -2

B -1

C 3

D 4

E 5

WORK SPACE

QUESTION

15

GRE

Statistics · Extreme Values

Target time · 1:45

If $r \le s \le t \le u \le v \le 110$ and the average (arithmetic mean) of r, s, t, u, and v is 100, what is the least possible value of r?

A 0

B 20

C 40

D 60

E 80

WORK SPACE

QUESTION

16

GMAT

Percents · Part of a Part

Target time · 2:00

In a certain nursery, 15 percent of the plants developed a fungus and died. If 40 percent of the plants that developed the fungus did not die, what percent of the plants in the nursery developed the fungus?

(A) 25%

(B) 27%

(C) 35%

(D) 40%

(E) 55%

WORK SPACE

QUESTION

17

GRE

Counting · Algebraic Expressions

Target time · 1:45

A rectangular game board is composed of identical squares arranged in a rectangular array of r rows and $r + 1$ columns. The r rows are numbered from 1 through r, and the $r + 1$ columns are numbered from 1 through $r + 1$. If $r > 10$, which of the following represents the number of squares on the board that are neither in the 4th row nor in the 7th column?

(A) $r^2 - r$

(B) $r^2 - 1$

(C) r^2

(D) $r^2 + 1$

(E) $r^2 + r$

WORK SPACE

QUESTION

18

GMAT

Statistics · Range

Target time · 2:00

The ten children in a certain group contributed a total of 28 pieces of clothing to a charity. If the range of the numbers of pieces of clothing contributed by the ten children was 2, which of the following could be the number of children in the group who contributed 3 pieces of clothing each?

I. 0

II. 5

III. 9

(A) II only

(B) III only

(C) I and II only

(D) I and III only

(E) I, II, and III

WORK SPACE

QUESTION

19

GRE

Rates · Unit Conversion

Target time · 1:45

The Sun is approximately 1,400 million kilometers from the planet Saturn, and light from the Sun travels to Saturn at the rate of approximately 300,000 kilometers per second. Approximately how many minutes does it take for light to travel from the Sun to Saturn?

(A) 80

(B) 130

(C) 160

(D) 280

(E) 360

WORK SPACE

QUESTION

20

GMAT

Algebra · Quadratics

Target time · 2:00

If x is a real number and $x + \sqrt{x} = 1$, which of the following is the value of $\sqrt{x}$?

(A) $\frac{1}{2}(\sqrt{5} - 1)$

(B) $\frac{1}{2}(\sqrt{5} + 1)$

(C) $\frac{1}{2}(\sqrt{5} - 3)$

(D) $\frac{1}{2}(\sqrt{5} + 3)$

(E) $\frac{1}{2}(3 - \sqrt{5})$

WORK SPACE

RECORD YOUR CHOICES

Answer sheet

Fill in one circle per question. Note your finish time against the 40-minute target.

1	A	B	C	D	E	2	A	B	C	D	E
3	A	B	C	D	E	4	A	B	C	D	E
5	A	B	C	D	E	6	A	B	C	D	E
7	A	B	C	D	E	8	A	B	C	D	E
9	A	B	C	D	E	10	A	B	C	D	E
11	A	B	C	D	E	12	A	B	C	D	E
13	A	B	C	D	E	14	A	B	C	D	E
15	A	B	C	D	E	16	A	B	C	D	E
17	A	B	C	D	E	18	A	B	C	D	E
19	A	B	C	D	E	20	A	B	C	D	E

FINISH TIME	CORRECT · OUT OF 20	LUCKY GUESSES

CHECK YOUR WORK

Answer key

#	EXAM	ANSWER	VALUE	TOPIC
1	GRE	A	12	Number Properties · Last Digits
2	GMAT	C	$\frac{2}{3}t$	Rates · Linear Change
3	GRE	D	$x^2 + 3x + 8$	Number Properties · Odd & Even
4	GMAT	E	825	Word Problems · Break-even
5	GRE	A	10	Exponents · Inequalities
6	GMAT	E	$\frac{(10^6)(77)}{3}$	Percents · Powers of 10
7	GRE	B	$33\frac{1}{3}\%$	Algebra · Inverse Variation
8	GMAT	C	II only	Number Properties · Divisibility
9	GRE	E	$1.38d$	Percents · Successive Changes
10	GMAT	E	II and III	Number Properties · Unit Fractions
11	GRE	D	4,400	Word Problems · Fractions
12	GMAT	D	16	Percents · Nested Groups
13	GRE	D	$\frac{3}{5}x + 32$	Statistics · Weighted Average
14	GMAT	D	4	Algebra · Integer Solutions
15	GRE	D	60	Statistics · Extreme Values
16	GMAT	A	25%	Percents · Part of a Part
17	GRE	A	$r^2 - r$	Counting · Algebraic Expressions
18	GMAT	D	I and III only	Statistics · Range
19	GRE	A	80	Rates · Unit Conversion
20	GMAT	A	$\frac{1}{2}(\sqrt{5} - 1)$	Algebra · Quadratics

SOLUTION · GRE

01

A ANSWER 12

THE QUESTION

If x and y are the tens digit and the units digit, respectively, of the product 725,278 × 67,066, what is the value of $x + y$?

! KEY IDEA

Only the last two digits of each factor can affect the last two digits of a product. Everything else adds whole hundreds.

STEP BY STEP

1. Keep only the last two digits of each number: 78 and 66.
2. Multiply:

   $78 \times 66 = 78 \times 60 + 78 \times 6 = 4{,}680 + 468 = 5{,}148$
3. The product ends in **48**, so $x = 4$ and $y = 8$.
4. $x + y = 4 + 8 = \mathbf{12}$.

TRAP TO AVOID

Finding only the units digit (8×6 ends in 8) and choosing (C) 8. The question needs the tens digit too.

FASTER ROUTE

Work mod 100: $78 \equiv -22$ and $66 \equiv -34$, so the product $\equiv 22 \times 34 = 748 \equiv 48$.

MY NOTES

SOLUTION · GMAT

02

ANSWER C $\frac{2}{3}t$

THE QUESTION

Candle A and Candle B have equal heights but different volumes. While the candles are burning, the height of each candle decreases at its own individual constant rate, with Candle A taking a total of t minutes to completely burn down and Candle B taking a total of $2t$ minutes to completely burn down. If both candles begin burning at the same time, in terms of t, how many minutes will it take for Candle B's height to be twice Candle A's height?

! KEY IDEA

Write each height as a fraction of the starting height. After m minutes, A has burned m/t of its height and B has burned m/(2t).

STEP BY STEP

1. After m minutes:
$$A = 1 - \frac{m}{t}, \quad B = 1 - \frac{m}{2t}$$
2. Set B = 2A:
$$1 - \frac{m}{2t} = 2 - \frac{2m}{t}$$
3. Collect terms: $\frac{2m}{t} - \frac{m}{2t} = 1$, so $\frac{3m}{2t} = 1$.
4. $$m = \frac{2}{3}t$$

TRAP TO AVOID

Choosing t, the moment A burns out. Then A = 0, and B is not twice 0.

FASTER ROUTE

Let $t = 3$ and the height be 6. A loses 2 per minute and B loses 1. At 2 minutes A = 2 and B = 4, twice A. 2 = (2/3)(3). ✓

MY NOTES

SOLUTION · GRE

03

D ANSWER $x^2 + 3x + 8$

THE QUESTION

If x is an integer, which of the following must be an even integer?

! KEY IDEA

$x^2 + x = x(x + 1)$ is a product of consecutive integers, so it is always even.

STEP BY STEP

1. Split the expression:
   $x^2 + 3x + 8 = (x^2 + x) + 2x + 8$
2. $x^2 + x$ is even; $2x$ is even; 8 is even.
3. Even + even + even = even, for every integer, so the answer is **(D)**.
4. Confirm the others fail with $x = 1$: (A) -1, (B) 3, (C) 1, (E) 13 are all odd.

TRAP TO AVOID

Testing only $x = 2$. Then (B) gives 2 and (E) gives 18, both even. “Must be” means every integer, so test an odd value too.

FASTER ROUTE

Plug in $x = 0$ and $x = 1$. Only (D) is even both times: 8 and 12.

MY NOTES

SOLUTION · GMAT

04

E ANSWER 825

THE QUESTION

For the rental of a certain type of car, Rental Agency R charges a fee of $30 per day plus a fee of $0.20 for each mile traveled in excess of 100 miles per day. For the rental of the same type of car, Rental Agency S charges a fee of $65 per day with free unlimited mileage. If a car of this type is to be rented for 3 days and will be driven the same number of miles each day, for what total number of miles will the cost of renting the car from Rental Agency R be the same as the cost of renting the car from Rental Agency S?

! KEY IDEA

Compare costs for one day. The extra mileage fee at R must make up the $35 gap between the two daily fees.

STEP BY STEP

1. Daily gap: $65 − $30 = $35.
2. Miles over 100 that cost $35:

   $35 \div 0.20 = 175$ miles
3. Miles per day: 100 + 175 = 275.
4. Total for 3 days:

   $3 \times 275 = 825$

TRAP TO AVOID

Reporting only the excess miles for 3 days, $3 \times 175 = 525$, which is (C). The first 100 miles each day are free but still driven.

FASTER ROUTE

Check 825: R charges 3(30) + 0.20(825 − 300) = 90 + 105 = $195; S charges 3(65) = $195. ✓

MY NOTES

SOLUTION · GRE

05

A ANSWER 10

THE QUESTION

What is the least integer n such that $\frac{1}{2^n} < 0.001$?

! KEY IDEA

Turn the decimal into a fraction and flip both sides. Memorize the benchmark $2^{10} = 1{,}024 \approx 1{,}000$.

STEP BY STEP

1. $0.001 = \frac{1}{1{,}000}$, so the inequality is $\frac{1}{2^n} < \frac{1}{1{,}000}$.
2. Both sides are positive, so flip:

   $2^n > 1{,}000$
3. $2^9 = 512$, which is too small. $2^{10} = 1{,}024$, which works.
4. The least integer is $n = \mathbf{10}$.

TRAP TO AVOID

Reading 2^n as $2n$. Then $2n > 1{,}000$ gives $n = 501$, choice (D).

FASTER ROUTE

Count powers of 2: 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024. The tenth one passes 1,000.

MY NOTES

SOLUTION · GMAT

06

ANSWER E $\frac{(10^6)(77)}{3}$

THE QUESTION

State X has 77 acres designated as wilderness, which is 0.0003 percent of its total acreage. Which of the following expresses the total acreage of State X ?

! KEY IDEA

"Percent" means divide by 100. Convert 0.0003 percent to a decimal before setting up part = rate × whole.

STEP BY STEP

1. $0.0003\% = \frac{0.0003}{100} = 0.000003 = 3 \times 10^{-6}$
2. $77 = 3 \times 10^{-6} \times \text{Total}$
3. $\text{Total} = \frac{77}{3 \times 10^{-6}} = \frac{(10^6)(77)}{3}$

TRAP TO AVOID

Treating 0.0003 percent as the decimal 0.0003. That gives $(10^4)(77)/3$, choice (D), which is 100 times too small.

FASTER ROUTE

Sanity check: 77 acres is a tiny share of a state, so the total must be huge, about 25 million acres. Only (B) and (E) are that large, and (B) multiplies by 3 instead of dividing.

MY NOTES

SOLUTION · GRE

07

B ANSWER $33\frac{1}{3}\%$

THE QUESTION

The quantities S and T are positive and are related by the equation $S = \frac{k}{T}$, where k is a constant. If the value of S increases by 50 percent, then the value of T decreases by what percent?

! KEY IDEA

$S = \frac{k}{T}$ means $S \times T = k$. When one factor grows, the other must shrink to keep the product fixed.

STEP BY STEP

1. An increase of 50% multiplies S by $\frac{3}{2}$.
2. To keep ST constant, T must be multiplied by $\frac{2}{3}$.
3. $$\text{Decrease} = 1 - \frac{2}{3} = \frac{1}{3} = 33\frac{1}{3}\%$$

TRAP TO AVOID

Assuming a 50% rise is undone by a 50% fall. Percent changes in opposite directions do not cancel.

FASTER ROUTE

Pick numbers: $S = 2$, $T = 3$, $k = 6$. S becomes 3, so $T = 2$. A drop of 1 out of 3 is 33⅓%.

MY NOTES

SOLUTION · GMAT

08

ANSWER
C II only

THE QUESTION

When the integer k^4 is divided by 32, the remainder is 0. Which of the following could be the remainder when the integer k is divided by 32 ?

I. 2
II. 4
III. 6

! KEY IDEA

$32 = 2^5$. Each factor of 2 in k gives four factors of 2 in k^4.

STEP BY STEP

1. If k has only one factor of 2, k^4 has $2^4 = 16$, which is not enough for 32.
2. So k needs at least 2^2: k is a multiple of 4.
3. If k is a multiple of 4, its remainder on division by 32 is also a multiple of 4.
4. 4 works ($k = 4$: $4^4 = 256 = 8 \times 32$). 2 and 6 are not multiples of 4. Answer: **II only**.

TRAP TO AVOID

Thinking k only needs to be even. $k = 2$ gives $2^4 = 16$, and 16 is not divisible by 32.

FASTER ROUTE

Test small cases: $2^4 = 16$ (no), $4^4 = 256$ (yes), $6^4 = 1{,}296 = 32 \times 40.5$ (no).

MY NOTES

SOLUTION · GRE

09

ANSWER E: $1.38d$

THE QUESTION

A car manufacturer produced a car at a cost of d dollars and sold it to a dealer at a price 20 percent higher than the production cost. If the dealer sold the car to a consumer for 15 percent more than the dealer paid for it, what did the car cost the consumer, in dollars?

! KEY IDEA

Each percent increase is a multiplier: +20% is × 1.20 and +15% is × 1.15. Successive changes multiply.

STEP BY STEP

1. Dealer's price:
   $1.20d$
2. Consumer's price:
   $1.15 \times 1.20d = 1.38d$
3. The answer is **(E)**.

TRAP TO AVOID

Adding the percents: 20% + 15% = 35%, giving (D) $1.35d$. The second 15% is taken on the larger price.

FASTER ROUTE

Let $d = 100$. The dealer pays 120; 15% of 120 is 18, so the consumer pays 138, which is $1.38d$.

MY NOTES

SOLUTION · GMAT

10

E ANSWER
II and III

THE QUESTION

If x, y, and z are positive integers such that $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$, which of the following could be the value of $x + y + z$?

I. 7
II. 9
III. 11

! KEY IDEA

Order the numbers $x \le y \le z$. The largest fraction, $1/x$, must be at least $1/3$, so x is 2 or 3.

STEP BY STEP

1. $x = 3$ forces $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$: sum = 9.
2. $x = 2$ leaves $\frac{1}{y} + \frac{1}{z} = \frac{1}{2}$, so y is 3 or 4.
3. $y = 3$ gives $z = 6$: $2 + 3 + 6 = 11$. $y = 4$ gives $z = 4$: $2 + 4 + 4 = 10$.
4. The only possible sums are 9, 10 and 11, so 7 is impossible. Answer: **II and III**.

TRAP TO AVOID

Finding the neat solution 3, 3, 3 and stopping there, which picks II only.

FASTER ROUTE

Reject 7 quickly: three positive integers adding to 7 include at least one ≥ 3 and the rest small, and none of the splits (1,1,5), (1,2,4), (1,3,3), (2,2,3) gives exactly 1.

MY NOTES

SOLUTION · GRE

11

D ANSWER 4,400

THE QUESTION

A developer has land that has x feet of lake frontage. The land is to be subdivided into lots, each of which is to have either 80 feet or 100 feet of lake frontage. If $\frac{1}{9}$ of the lots are to have 80 feet of frontage each and the remaining 40 lots are to have 100 feet of frontage each, what is the value of x?

! KEY IDEA

If 1/9 of the lots are one type, the "remaining 40" are the other 8/9 of the total.

STEP BY STEP

1. $\frac{8}{9} \times \text{total} = 40$, so total = 45 lots
2. 80-foot lots: $45 - 40 = 5$.
3. $x = 5(80) + 40(100) = 400 + 4{,}000 = 4{,}400$

TRAP TO AVOID

Treating 40 as the total number of lots, or reporting only the 80-foot frontage, 400, which is (A).

FASTER ROUTE

The total must be a multiple of 9, and 8/9 of it must be 40. Only 45 works.

MY NOTES

SOLUTION · GMAT

12

D ANSWER 16

THE QUESTION

During a certain year, 80 percent of the visitors to the Smithsonian Institution were United States citizens, 50 percent of the remaining visitors were Canadian or Mexican citizens, and 50 percent of the visitors who were not citizens of the United States, Canada, or Mexico were citizens of European countries. The number of United States citizens who visited the Smithsonian that year was approximately how many times the number of citizens of European countries who visited the Smithsonian that year?

! KEY IDEA

Use 100 visitors and take each percent of what remains, not of the whole.

STEP BY STEP

1. US citizens: 80. Remaining: 20.
2. Canadian or Mexican: 50% of 20 = 10. Remaining: 10.
3. European: 50% of 10 = 5.
4. $80 \div 5 = 16$

TRAP TO AVOID

Taking each 50% of all 100 visitors, or stopping at $80 \div 10 = 8$, which is (C).

FASTER ROUTE

Multiply the shares: European = $0.2 \times 0.5 \times 0.5 = 0.05$ of visitors, and $0.80 \div 0.05 = 16$.

MY NOTES

SOLUTION · GRE

13

ANSWER D $\frac{3}{5}x + 32$

THE QUESTION

A tailor used 30 buttons that had an average (arithmetic mean) weight of x grams per button and 20 other buttons that had an average weight of 80 grams per button. Which of the following is the average weight per button, in grams, of the 50 buttons that the tailor used?

! KEY IDEA

Average = total ÷ count. Turn each group's average into a total first.

STEP BY STEP

1. Total weight:

$$30x + 20(80) = 30x + 1{,}600$$

2. Average:

$$\frac{30x + 1{,}600}{50} = \frac{3}{5}x + 32$$

3. The answer is **(D)**.

TRAP TO AVOID

(A) forgets to multiply x by 30: it treats the first group as a single button.

FASTER ROUTE

Let $x = 80$. Every button weighs 80, so the average must be 80. Only (D) gives 48 + 32 = 80.

MY NOTES

SOLUTION · GMAT

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D ANSWER 4

THE QUESTION

If x and y are integers and if $(x - y)^2 + 2y^2 = 27$, which of the following could be the value of x?

! KEY IDEA

Both terms are non-negative, so $2y^2 \leq 27$. That leaves only a few values of y to test.

STEP BY STEP

1. y^2 can be 0, 1, 4 or 9, so $2y^2$ is 0, 2, 8 or 18.
2. Then $(x - y)^2$ is 27, 25, 19 or 9. Only 25 and 9 are perfect squares.
3. $y = \pm 1$: $x - y = \pm 5$, so $x = 6, -4, 4$ or -6.
4. $y = \pm 3$: $x - y = \pm 3$, so $x = 6, 0$ or -6.
5. Of the choices, only **4** appears ($x = 4$, $y = -1$).

TRAP TO AVOID

Testing only positive y. $x = 4$ comes from $y = -1$.

FASTER ROUTE

Plug the choices: $x = 4$, $y = -1$ gives $5^2 + 2 = 27$. ✓

MY NOTES

SOLUTION · GRE

15

D ANSWER 60

THE QUESTION

If $r \le s \le t \le u \le v \le 110$ and the average (arithmetic mean) of r, s, t, u, and v is 100, what is the least possible value of r?

! KEY IDEA

A fixed sum means that making one value small requires making the others as large as allowed.

STEP BY STEP

1. Sum of the five numbers:
   $5 \times 100 = 500$
2. Make s, t, u, v as large as possible: 110 each, a total of 440.
3. $r = 500 - 440 = 60$
4. Check the order: $60 \le 110 \le 110 \le 110 \le 110$. ✓

TRAP TO AVOID

Choosing 0 because nothing says the numbers are positive. The cap of 110 and the fixed average are what limit r.

FASTER ROUTE

Think of the 10-point surplus: each of the four numbers can sit 10 above the average, a total surplus of 40, so r must sit 40 below it: 100 − 40 = 60.

MY NOTES

SOLUTION · GMAT

16

ANSWER A 25%

THE QUESTION

In a certain nursery, 15 percent of the plants developed a fungus and died. If 40 percent of the plants that developed the fungus did not die, what percent of the plants in the nursery developed the fungus?

! KEY IDEA

If 40% of the fungus plants survived, the 15% that died is the other 60% of the fungus plants.

STEP BY STEP

1. Let F = percent of plants with the fungus.
2. $0.60 \times F = 15\%$
3. $F = 15\% \div 0.60 = 25\%$

TRAP TO AVOID

Adding 15% + 40% = 55%, choice (E). The 40% is a share of the fungus plants, not of all plants.

FASTER ROUTE

Use 100 plants: 15 died of fungus. If they are 60% of the fungus plants, 15 = 0.6F gives F = 25.

MY NOTES

SOLUTION · GRE

17

ANSWER A $r^2 - r$

THE QUESTION

A rectangular game board is composed of identical squares arranged in a rectangular array of r rows and $r + 1$ columns. The r rows are numbered from 1 through r, and the $r + 1$ columns are numbered from 1 through $r + 1$. If $r > 10$, which of the following represents the number of squares on the board that are neither in the 4th row nor in the 7th column?

KEY IDEA

Deleting one full row and one full column leaves a smaller rectangle: one row fewer and one column fewer.

STEP BY STEP

1. Rows left: $r - 1$. Columns left: $(r + 1) - 1 = r$.
2. $(r - 1) \times r = r^2 - r$
3. $r > 10$ only guarantees that a 4th row and a 7th column exist.

TRAP TO AVOID

Removing only the row gives $(r - 1)(r + 1) = r^2 - 1$, choice (B). Removing only the column gives r^2, choice (C).

FASTER ROUTE

Let $r = 11$: $11 \times 12 = 132$ squares. Row 4 has 12, column 7 has 11, and they share 1: $132 - 12 - 11 + 1 = 110 = 11^2 - 11$.

MY NOTES

SOLUTION · GMAT

18

D ANSWER
I and III only

THE QUESTION

The ten children in a certain group contributed a total of 28 pieces of clothing to a charity. If the range of the numbers of pieces of clothing contributed by the ten children was 2, which of the following could be the number of children in the group who contributed 3 pieces of clothing each?

I. 0
II. 5
III. 9

! KEY IDEA

The average is 2.8, so with a range of 2 the values are either 1, 2, 3 or 2, 3, 4, and each set must include both its smallest and largest value.

STEP BY STEP

1. Values 2, 3, 4 (at least one 2 and one 4): six 2s and four 4s give 12 + 16 = 28 with **zero** 3s. I works.
2. Values 1, 2, 3 (at least one 1 and one 3): one 1 and nine 3s give 1 + 27 = 28 with **nine** 3s. III works.
3. Five 3s is impossible. With values 2, 3, 4 the number of 3s must be even. With values 1, 2, 3 the only way to reach 28 is one 1 and nine 3s. II fails.
4. Answer: **I and III only**.

TRAP TO AVOID

Assuming everyone must give between 2 and 4 because the average is 2.8. The set 1, 3, 3, ..., 3 also works.

FASTER ROUTE

With values 2, 3, 4, the equations give b + 2c = 8, so the number of 3s (b) is always even. With values 1, 2, 3, only one 1 and nine 3s reach 28.

MY NOTES

SOLUTION · GRE

19

A ANSWER 80

THE QUESTION

The Sun is approximately 1,400 million kilometers from the planet Saturn, and light from the Sun travels to Saturn at the rate of approximately 300,000 kilometers per second. Approximately how many minutes does it take for light to travel from the Sun to Saturn?

! KEY IDEA

Time = distance ÷ rate, then convert to the unit the question asks for, here minutes.

STEP BY STEP

1. Write in powers of 10:

$$\frac{1.4 \times 10^9}{3 \times 10^5} \approx 0.467 \times 10^4 \approx 4{,}667 \text{ seconds}$$

2. Convert to minutes: 4,667 ÷ 60 ≈ 78 minutes.

3. The closest choice is **80**.

TRAP TO AVOID

Stopping at seconds, or misreading "1,400 million" as 1.4 million, which gives a far smaller answer.

FASTER ROUTE

Round early: 1,400,000,000 ÷ 300,000 ≈ 4,700 seconds, and 4,800 seconds is exactly 80 minutes.

MY NOTES

SOLUTION · GMAT

20

ANSWER A $\frac{1}{2}(\sqrt{5}-1)$

THE QUESTION

If x is a real number and $x + \sqrt{x} = 1$, which of the following is the value of $\sqrt{x}$?

KEY IDEA

Let $s = \sqrt{x}$. Then $x = s^2$, and the equation becomes a quadratic in s.

STEP BY STEP

1. $s^2 + s - 1 = 0$
2. Quadratic formula:
$$s = \frac{-1 \pm \sqrt{5}}{2}$$
3. $\sqrt{x}$ cannot be negative, so take the + sign: $s = \frac{1}{2}(\sqrt{5}-1)$.

TRAP TO AVOID

Choice (E), $\frac{1}{2}(3-\sqrt{5})$, is the value of x, not $\sqrt{x}$. Check what the question asks for.

FASTER ROUTE

Estimate: $\sqrt{5} \approx 2.24$. (A) ≈ 0.62 and $0.62 + 0.62^2 \approx 0.62 + 0.38 = 1$. ✓

MY NOTES

KEEP GOING

What's next

Redo every question you missed without a timer, then try it again two days later. If you can explain the trap out loud, you have learned the question.

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