

ACT Mathematics Practice Test B

Q.#.	Correct Answer	Cluster	Q#	Correct Answer	Cluster	
1	C	PA	31	D	IA/CG	SUMMARY
2	J	EA	32	H	IA/CG	PA/EA - 26
3	E	PG	33	A	PA	IA/CG - 17
4	J	EA	34	J	T	PG/T - 17
5	A	PA	35	C	PG	
6	H	T	36	F	IA/CG	
7	B	PG	37	C	EA	
8	F	IA/CG	38	F	EA	
9	A	EA	39	C	IA/CG	
10	J	PA	40	G	PG	
11	D	PG	41	D	PG	
12	K	IA/CG	42	J	EA	
13	C	EA	43	E	EA	
14	K	PA	44	K	PA	
15	E	IA/CG	45	A	EA	
16	G	PG	46	G	T	
17	D	IA/CG	47	D	EA	
18	H	PA	48	J	IA/CG	
19	B	PA	49	B	PG	
20	F	EA	50	H	IA/CG	
21	D	IA/CG	51	A	PG	
22	H	IA/CG	52	H	PG	
23	C	IA/CG	53	C	EA	
24	H	IA/CG	54	J	EA	
25	A	PG	55	A	T	
26	G	PA	56	F	EA	
27	D	IA/CG	57	A	EA	
28	J	IA/CG	58	H	EA	
29	D	EA	59	E	PG	
30	H	IA/CG	60	F	PG	

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1. In one city the taxicabs charge \$2.50 for the first mile and \$0.75 for each additional $\frac{1}{8}$ of a mile. What is the cost of a $3\frac{1}{4}$ mile trip?

A. \$13.50 B. \$14.50 C. \$16.00 D. \$18.00 E. \$26.00

Answer: C

Cost for 1st mile is \$2.50. There are $3\frac{1}{4} - 1 = 2\frac{1}{4}$ miles remaining. The number of $\frac{1}{8}$ in $2\frac{1}{4} = 2\frac{1}{4} \div \frac{1}{8} = 18$.
 Cost = \$2.50 + 18(\$0.75) = \$16.00.

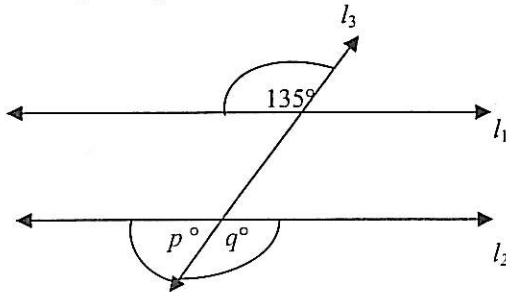
2. $\left(\frac{1}{3}\right)^4 - \left(\frac{1}{3}\right)^3 = ?$

F. $\frac{1}{3}$ G. $\frac{1}{9}$ H. $\frac{1}{81}$ J. $-\frac{2}{81}$ K. $-\frac{1}{3}$

Answer: J

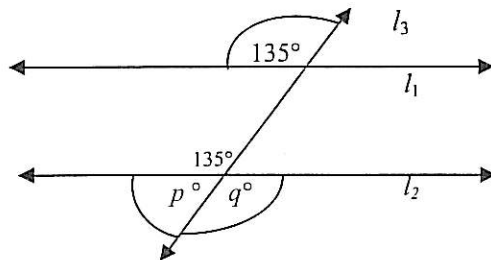
$$\left(\frac{1}{3}\right)^4 - \left(\frac{1}{3}\right)^3 = \frac{1}{81} - \frac{1}{27} = \frac{1}{81} - \frac{3}{81} = -\frac{2}{81}$$

3. In the figure $l_1 \parallel l_2$ and l_3 is a transversal. What is the value of $q - p$?



A. 0° B. 45° C. 55° D. 60° E. 90°

Answer: E



The given 135° equals its corresponding pair as shown in the diagram. $p + 135 = 180$. Sum of angles on a straight line = 180° . $p = 45^\circ$; $q = 135^\circ$ vertical angles are \cong . So $q - p = 135^\circ - 45^\circ = 90^\circ$

4. Six calculators cost \$x. What is the cost of y less calculators?

F. $\frac{6-x}{y}$ G. $\frac{y-6}{x}$ H. $\frac{x-6}{6y}$ J. $\frac{x(6-y)}{6}$ K. $6x(y-6)$

Answer: J

Using a proportion to compare the number of calculators to their cost and let c represent the cost of y less calculators (i.e., $6 - y$ calculators). So,

$$\frac{6}{x} = \frac{6-y}{c}$$

$$6c = x(6-y)$$

$$c = \frac{x(6-y)}{6}$$

5. Jean bought a used car for \$2,800 plus 6% tax. How much more would she have paid for the car if the sales tax were 7% instead of 6%?
- A. \$28 B. \$56 C. \$168 D. \$196 E. \$336

Answer: A

Since the amount of money, \$2,800, is the same, she would have paid $7\% - 6\% = 1\%$ more. She would have paid $1\% \times \$2,800 = \28 .

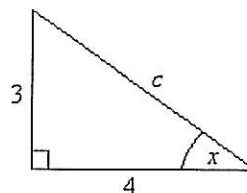
6. If $\tan x = \frac{3}{4}$, what is the value of $\cos x + \sin x$?
- F. $\frac{4}{3}$ G. $\frac{9}{16}$ H. $\frac{7}{5}$ J. $\frac{25}{12}$ K. 1

Answer: H

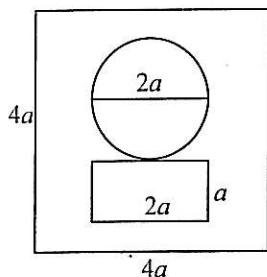
The right triangle shows $\tan x = \frac{3}{4}$. From Pythagorean Theorem, the unknown side, c , is calculated as $c^2 = 3^2 + 4^2 = 25$

$$c = \sqrt{25} = 5;$$

$$\text{now } \cos x + \sin x = \frac{4}{5} + \frac{3}{5} = \frac{7}{5}$$



7. A square sheet of metal with sides $4a$ has a circle of diameter $2a$ and a rectangle of length $2a$ and width a removed from it. What is the area of the remaining metal?



- A. $4a - 4\pi a^2 - 2a^2$ B. $14a^2 - \pi a^2$ C. $14a^2 - 4\pi a^2$ D. $4a^2 + \pi a^2 - a$ E. $4a^2 - 2\pi a^2$

Answer: B

Area of metal remaining = area of square - (area of circle + area of rectangle) = $5^2 - (\pi r^2 + lw)$

$$\text{Area of metal remaining} = (4a)^2 - (\pi(a)^2 + (2a)(a)) = 16a^2 - \pi a^2 - 2a^2 = 14a^2 - \pi a^2$$

8. Which of the following equations has a graph that is a line perpendicular to the graph of $x + 2y = 6$?
- F. $2x - y = 3$ G. $2x + y = -3$ H. $x - 2y = 3$ J. $y + x = 3$ K. $2y + x = -3$

Answer: F

Arranging the equation in slope intercept form $y = mx + b$, we get $x + 2y = 6 \Rightarrow 2y = -x + 6 \Rightarrow y = -\frac{1}{2}x + 3$.

Any line perpendicular to this one will have a slope = $-\left(\frac{2}{-1}\right) = 2$. By inspection and arranging in slope intercept form, choice A. $2x - y = 3$ has slope 2, because $-y = -2x + 3$ or $y = 2x - 3$ with slope 2.

9. If $x = ut + \frac{1}{2}at^2$, what is t when $x = 16$, $u = 0$, and $a = 4$?

- A. $2\sqrt{2}$ B. $4\sqrt{2}$ C. $\sqrt{2}$ D. 2 E. 4

Answer: A

$$x = ut + \frac{1}{2}at^2$$

$$16 = 0(t) + \frac{1}{2}(4)t^2 = 2t^2$$

$$8 = t^2$$

$$t = \sqrt{8} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$$

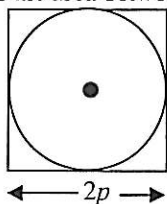
10. If 18% of the senior class of 200 students were absent from school, how many students were present?

- F. 38 G. 120 H. 136 J. 164 K. 182

Answer: J

If 18% of the students were absent, 82% were present. # of students present = $82\% \times 200 = 164$.

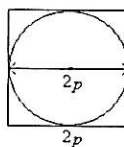
11. What is the area between the square and circle shown?



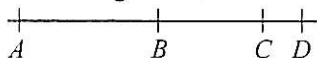
- A. $4p^2(1 - \pi)$ B. $p^2(4 - 2\pi)$ C. $4p^2(1 + \pi)$ D. $p^2(4 - \pi)$ E. $p^2(\pi - 4)$

Answer: D

$$\begin{aligned} \text{Area between shapes} &= \text{area of square} - \text{area of circle} \\ &= 5^2 - \pi r^2 = (2p)^2 - \pi(p)^2 \\ &= 4p^2 - \pi p^2 = p^2(4 - \pi) \end{aligned}$$



12. The points A , B , C , and D divide the line segment AD in the ratio $4 : 3 : 1$, respectively, and $AB = 24$ cm. What is the length of BD ?



- F. 12 cm G. 14 cm H. 18 cm J. 19 cm K. 24 cm

Answer: K

$AB = 24$ cm represents 4 equal parts. Then, 1 part represents $\frac{24}{4} = 6$ cm. Since BD represents 4 parts total, then $BD = 4(6) = 24$ cm.

13. $\frac{2a-3}{2} - \frac{5a+3}{5} = ?$

- A. -21 B. -9 C. $-\frac{21}{10}$ D. $-\frac{9}{10}$ E. $\frac{9}{10}$

Answer: C

$$\frac{2a-3}{2} - \frac{5a+3}{5} = \frac{5(2a-3)}{10} - \frac{2(5a+3)}{10} = \frac{10a-15-10a-6}{10} = \frac{-21}{10}$$

14. A plumber charges \$35 flat fee plus \$25 per hour. If his bill was \$147.50, how long did the job take?

- F. $1\frac{1}{2}$ G. $1\frac{3}{4}$ H. $2\frac{1}{4}$ J. $3\frac{1}{2}$ K. $4\frac{1}{2}$

Answer: K

Total hourly charges = \$147.50 - \$35 = \$112.50. At \$25 per hour, number of hours = $\frac{\$112.50}{25} = 4\frac{1}{2}$

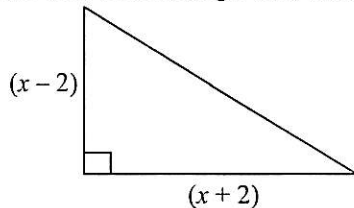
15. If $a = 1$, what is the value of $[(a + 3)^2 - (a - 3)^2]^2$?

- A. 10 B. 12 C. 24 D. 120 E. 144

Answer: E

$$\begin{aligned} \text{When } a = 1, \quad & [(a + 3)^2 - (a - 3)^2]^2 = [(1 + 3)^2 - (1 - 3)^2]^2 \\ & = [4^2 - (-2)^2]^2 \\ & = [16 - 4]^2 \\ & = [12]^2 \\ & = 144 \end{aligned}$$

16. If the area of the triangle is 8, what is the value of x ?



- F. $5\sqrt{2}$ G. $2\sqrt{5}$ H. $4\sqrt{3}$ J. $2\sqrt{3}$ K. $3\sqrt{2}$

Answer: G

The area of a Δ is given by $A = \frac{1}{2}bh$

$$8 = \frac{1}{2}(x+2)(x-2) = \frac{x^2 - 4}{2}$$

$$16 = x^2 - 4$$

$$20 = x^2$$

$$x = \sqrt{20} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$$

17. $2\sqrt{24} - 2\sqrt{2} \times \sqrt{3} = ?$

- A. 0 B. $3\sqrt{24}$ C. -6 D. $2\sqrt{6}$ E. $4\sqrt{6}$

Answer: D

$$2\sqrt{24} - 2(\sqrt{2})(\sqrt{3}) = 2\sqrt{4} \cdot \sqrt{6} - 2\sqrt{6} = 4\sqrt{6} - 2\sqrt{6} = 2\sqrt{6}$$

18. Vijay saves 20% on a \$125 bowling ball but must pay 6% sales tax. What is the total he must pay?

- F. \$94.00 G. \$100.00 H. \$106.00 J. \$107.50 K. \$205.00

Answer: H

If he saved 20%, he paid 80% of the original price or $80\% \times \$125 = \100 . 6% tax = $.06 \times \$100 = \6 . He paid $\$100 + \$6 = \$106$.

19. The average (mean) temperature for five days was 2° . If the temperatures for the first four days were -10° , 30° , 0° and -5° , what was the temperature on the fifth day?

- A. -10° B. -5° C. 0° D. 5° E. 20°

Answer: B

The mean temperature for 5 days was 2° . Then the total temperature for 5 days was $5 \times 2^\circ = 10^\circ$. Total for the first 4 days = $-10^\circ + 30^\circ + 0^\circ + -5^\circ = 15^\circ$. So the temperature on the 5th day = $10^\circ - 15^\circ = -5^\circ$.

20. $\frac{2}{17} \div \frac{-4}{34} \div \frac{-1}{2} = ?$

- F. 2 G. $\frac{1}{2}$ H. 0 J. $-\frac{1}{2}$ K. -2

Answer: F

$$\frac{2}{17} \div \frac{-4}{34} \div \frac{-1}{2} = \left(\frac{2}{17} \times \frac{34}{-4} \right) \div \frac{-1}{2} = -1 \times \frac{2}{-1} = 2$$

21. If $(x+2)^2 = (2^2)^3$ and $x > 0$, what is the value of x ?

- A. 2 B. 3 C. 4 D. 6 E. -10

Answer: D

$$(x+2)^2 = 4^3$$

$$(x+2)^2 = 64$$

$$x+2 = +/-8$$

$$x = 8-2 \text{ or } x = -8-2$$

$$x = 6 \text{ or } x = -10 \quad \text{but } x > 0 \text{ so } x = 6$$

22. Solve $x^2 + 3x + 2 = 0$.

- F. $\{-2, -3\}$ G. $\{-2, 3\}$ H. $\{-1, -2\}$ J. $\{-1, 2\}$ K. $\{1, 2\}$

Answer: H

$$x^2 + 3x + 2 = 0$$

$$(x+2)(x+1) = 0$$

$$x+2 = 0 \text{ or } x+1 = 0$$

$$x = -2 \text{ or } x = -1$$

23. If the endpoints of the diameter of a circle in the x - y plane have coordinates $\left(-\sqrt{2}, \sqrt{\frac{3}{2}}\right)$ and $\left(\sqrt{2}, -\sqrt{\frac{3}{2}}\right)$, what are the coordinates of the center?

- A. $(2\sqrt{2}, -\sqrt{3})$ B. $(2, -\frac{3}{4})$ C. $(0, 0)$ D. $(\sqrt{3}, -\sqrt{3})$ E. $(-2, -\frac{3}{4})$

Answer: C

If $\left(-\sqrt{2}, \sqrt{\frac{3}{2}}\right)$ and $\left(\sqrt{2}, -\sqrt{\frac{3}{2}}\right)$ are the endpoints of the diameter of a circle, its center is at the midpoint of the

segment with endpoints given by $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-\sqrt{2} + \sqrt{2}}{2}, \frac{\sqrt{\frac{3}{2}} - \sqrt{\frac{3}{2}}}{2}\right) = (0, 0)$.

24. What is the equation of the line, in standard form, connecting points $(2, -3)$ and $(4, 4)$?

- F. $7x - 2y - 26 = 0$ G. $7x + y - 13 = 0$ H. $7x - 2y - 20 = 0$
J. $2x - 2y - 7 = 0$ K. $3x - y + 10 = 0$

Answer: H

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-3)}{4 - 2} = \frac{4 + 3}{2} = \frac{7}{2}$, using $y - y_1 = m(x - x_1)$ for the equation of a line,

$$y - (-3) = \frac{7}{2}(x - 2)$$

$$y + 3 = \frac{7}{2}x - 7$$

$$2y + 6 = 7x - 14$$

$$2y - 7x + 20 = 0$$

Standard form is: $Ax + By + C = 0$

$$-7x + 2y + 20 = 0$$

$$7x - 2y - 20 = 0$$

25. If quadrilateral $ABCD$ is a parallelogram with an area of 180 square units and a base of 20 units, what is its height?

- A. 9 B. 5 C. 4 D. $3\frac{1}{2}$ E. $1\frac{1}{4}$

Answer: A

Area of a parallelogram is given by $A = bh$. Here $A = 180$ and $b = 20$. So,

$$180 = 20h$$

$$9 = h$$

26. $0.25 \div \left(\frac{1}{4} \div \frac{25}{100}\right) = ?$

- F. $\frac{1}{16}$ G. $\frac{1}{4}$ H. 1 J. 4 K. 16

Answer: G

Notice 0.25 and $\frac{25}{100}$ both $= \frac{1}{4}$. So $0.25 \div \left(\frac{1}{4} \div \frac{25}{100}\right) = \frac{1}{4} \div \left(\frac{1}{4} \div \frac{1}{4}\right) = \frac{1}{4} \div 1 = \frac{1}{4}$.

27. If $x + y = 4$ and $2x - y = 5$, what is the value of $x + 2y$?

- A. 1 B. 2 C. 4 D. 5 E. 6

Answer: D

adding,

$$x + y = 4$$

$$+ 2x - y = 5$$

$$3x = 9 \text{ and } x = 3$$

Putting $x = 3$ in the first equation, we get $3 + y = 4$, so $y = 1$. Now $x + 2y = 3 + 2(1) = 5$.

28. If $5x + 3y = 23$ and x and y are positive integers, then which of the following can be equal to y ?

- F. 3 G. 4 H. 5 J. 6 K. 7

Answer: J

By examination of the answer choices we need y so that $23 - 3y$ will be a multiple of 5. Only $y = 6$ will do.

29. Which equation could be used to find the unknown, if $\frac{1}{2}$ less than $\frac{3}{5}$ of a number is the same as the number?

- A. $\frac{1}{2} - \frac{3}{5}x = \frac{1}{2}$ B. $\frac{1}{2} - \frac{3}{5}x = x$ C. $x - \frac{1}{2} = \frac{3}{5}x$ D. $\frac{3}{5}x - \frac{1}{2} = x$ E. $\frac{1}{2} - x = \frac{3}{5}x$

Answer: D

$$\frac{3}{5}x - \frac{1}{2} = x$$

30. If x^* means $4(x - 2)^2$, what is the value of $(3^*)^*$?

- F. 8 G. 12 H. 16 J. 36 K. None of the above

Answer: H

$$(3^*)^* = (4(3 - 2)^2)^* = (4)^* = 4(4 - 2)^2 = 4 \cdot 4 = 16$$

31. What is the vertex of the parabola $y = (x + 3)^2 - 6$?

- A. (3, 6) B. (-3, 6) C. (3, -6) D. (-3, -6) E. None of the above

Answer: D

If $y = (x - k)^2 + h$ is a parabola, its vertex is (k, h) . Comparing to $y = (x + 3)^2 - 6 = (x - (-3))^2 + (-6)$

The vertex is $(-3, -6)$.

32. What is the slope of the line connecting the points (2, -2) and (3, -2)?

- F. undefined G. 1 H. 0 J. -1 K. -4

Answer: H

$$\text{Slope } m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-2)}{3 - 2} = \frac{0}{1} = 0$$

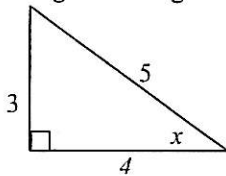
33. Which of the following is not equal to the other four?

- A. 1.1×10 B. 110% C. $\sqrt{1.21}$ D. $\frac{11}{10}$ E. $1 + \frac{1}{10}$

Answer: A

- A. $1.1 \times 10 = 11$ B. $110\% = 1.1$ C. $\sqrt{1.21} = 1.1$ D. $\frac{11}{10} = 1.1$ E. $1 + \frac{1}{10} = 1.1$

34. According to the diagram, which of the following statements is true?

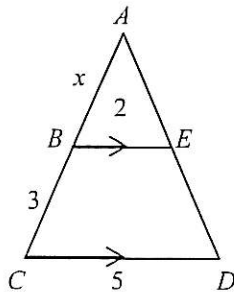


- F. $\sin x = \frac{5}{3}$ G. $\cos x = \frac{3}{5}$ H. $\tan x = \frac{5}{4}$ J. $\cos x = \frac{4}{5}$ K. $\sin x = \frac{4}{5}$

Answer: J

$$\cos x = \frac{4}{5}$$

35. If $\triangle ABE$ is similar to $\triangle ACD$, what is the value of AB ?



- A. $7\frac{1}{2}$ B. 3 C. 2 D. $1\frac{1}{2}$ E. -2

Answer: C

If $\triangle ABE$ is similar to $\triangle ACD$, then

$$\frac{x}{x+3} = \frac{2}{5}$$

$$5x = 2(x+3) = 2x+6$$

$$3x = 6$$

$$x = 2, \text{ thus } AB = 2$$

36. What is the probability of selecting a letter M or T, if the letters M, A, T, H, E, M, A, T, I, C, and S are drawn randomly from a bag?

- F. $\frac{4}{11}$ G. $\frac{3}{11}$ H. $\frac{2}{11}$ J. $\frac{1}{11}$ K. 0

Answer: F

$$P(\text{M or T}) = \frac{\# \text{ of M's and T's}}{\text{Total \# of letters}} = \frac{4}{11}$$

37. A salesman is paid \$150/week plus $x\%$ commission on all sales. If he had $\$s$ in sales, what was the amount of his paycheck (p)?

A. $p = 150 + \frac{xs}{10}$ B. $p = 150 + s$ C. $p = 150 + 0.01xs$ D. $p = 150 + xs$ E. $p = 150 + 100xs$

Answer: C

$$p = 150 + x\%(s) = 150 + 0.01xs$$

38. If $2 + \frac{x}{(x-2)} = 4$, what is the value of $-|x|$?

F. -4 G. -2 H. 0 J. 2 K. 4

Answer: F

Choices H, J, and K are ruled out because $-1 \times 1 < 0$.

$$\begin{aligned} 2 + \frac{x}{x-2} = 4, \text{ then } 2(x-2) + x &= 4(x-2) \\ 2x - 4 + x &= 4x - 8 \\ 3x - 4x &= -8 + 4 \\ -x &= -4 \\ x &= 4 \end{aligned}$$

So $-|x| = -|4| = -4$.

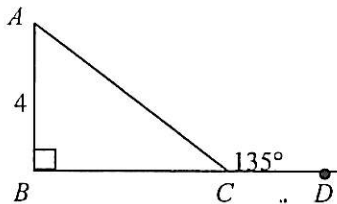
39. Which of the following lines is parallel to $2y = 3x - 1$?

A. $y = \frac{1}{3}x - 1$ B. $2y = x - 3$ C. $4y = 6x + 8$ D. $y = 3x + 4$ E. $3y = 2x - 3$

Answer: C

If the equation of a line is written in the form $y = mx + b$, m is the slope of the line. For $2y = 3x - 1$, $y = \frac{3}{2}x - \frac{1}{2}$. Since parallel lines have equal slopes, we see that choice C, which can be written $y = \frac{6}{4}x + \frac{8}{4} \Rightarrow y = \frac{3}{2}x + 2$ has an equal slope.

40. Given $\triangle ABC$ with $AB = 4$ and $m \angle ACD = 135^\circ$, what is the value of AC ?



F. 4 G. $4\sqrt{2}$ H. $3\sqrt{2}$ J. 8 K. 5

Answer: G

Since angles on a straight line = 180° , $m \angle ACB = 180^\circ - 135^\circ = 45^\circ$ and $m \angle BAC = 180^\circ - 90^\circ - 45^\circ = 45^\circ$. $\triangle ABC$ is isosceles, so $BC = 4$. Using the Pythagorean Theorem,

$$\begin{aligned} 4^2 + 4^2 &= AC^2 \\ 32 &= AC^2 \end{aligned}$$

$$AC = \sqrt{32} = \sqrt{16} \cdot \sqrt{2} = 4\sqrt{2}$$

41. If the diameter of a bicycle wheel is 50 centimeters, how many revolutions will the wheel make to cover a distance of 100π meters?

A. 12 B. 20 C. 120 D. 200 E. 1200

Answer: D

In one revolution, the distance traveled by the wheel is its circumference = $\pi d = 50\pi$ cm. For a distance of 100π m = $10,000\pi$ cm, the number of revolutions = $\frac{10000\pi}{50\pi} = 200$.

42. If $x^* = x + 2$, what is the value of $(3^* + 5^*)^*$?

- F. 8 G. 10 H. 12 J. 14 K. None of the above

Answer: J

Since $x^* = x + 2$, then $(3^* + 5^*)^* = (3 + 2 + 5 + 2)^* = 12^* = 12 + 2 = 14$

43. If $\frac{15k}{3kx+16} = 1$ and $x = 4$, what is the value of k ?

- A. 2 B. 3 C. 4 D. 8 E. $\frac{16}{3}$

Answer: E

$$\begin{aligned} \text{If } x = 4, \quad \frac{15k}{12k+16} &= 1 \\ 15k &= 12k + 16 \\ 3k &= 16 \\ k &= \frac{16}{3} \end{aligned}$$

44. $-7 - 3 \times 2(-5) + 6 - 21 \div 3 = ?$

- F. 99 G. 95 H. 33 J. 25 K. 22

Answer: K

$$-7 - 3 \cdot 2(-5) + 6 - 21 \div 3 = -7 - 3 \cdot -10 + 6 - 7 = -7 + 30 + 6 - 7 = 23 - 1 = 22$$

45. Simplify $\frac{3y}{10} + \frac{7y-2}{5}$.

- A. $\frac{17y-4}{10}$ B. $\frac{10y-2}{15}$ C. $\frac{4y-2}{10}$ D. $\frac{85y-2}{50}$ E. $\frac{10y-2}{5}$

Answer: A

$$\frac{3y}{10} + \frac{7y-2}{5} = \frac{3y}{10} + \frac{14y-4}{10} = \frac{17y-4}{10}$$

46. Which of the following is equivalent to $\frac{\cos x}{\sin x} + \frac{\sin x}{\cos x}$?

- F. $\frac{\cos x + \sin x}{\sin x \cos x}$ G. $\frac{1}{\sin x \cos x}$ H. $\tan x + \cos^2 x$ J. $\sin x \cos x$ K. $2 \sin x \cos x$

Answer: G

$$\frac{\cos x}{\sin x} + \frac{\sin x}{\cos x} = \frac{\cos x \cos x}{\sin x \cos x} + \frac{\sin x \sin x}{\sin x \cos x} = \frac{\cos^2 x + \sin^2 x}{\sin x \cos x} = \frac{1}{\sin x \cos x} \quad (\text{since } \sin^2 x + \cos^2 x = 1)$$

47. $(-2, -3)$ is a solution to which inequality?

- A. $2y \geq 3x + 1$ B. $-2y \leq -x + 3$ C. $\frac{x}{2} \geq 4 - y$ D. $y - 2 \geq (x - 3)$ E. $x - y < 0$

Answer: D

$y - 2 \geq (x - 3)$ is the inequality for which $(-2, -3)$ is a solution, because $-3 - 2 \geq (-2 - 3)$, $-5 \geq -5$ is true.

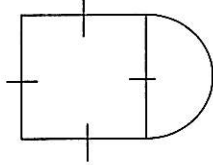
48. What is the distance between the points $(-3, 4)$ and $(9, 9)$?

- F. 5 G. $5\sqrt{2}$ H. 12 J. 13 K. 17

Answer: J

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(9 - (-3))^2 + (9 - 4)^2} = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$$

49. If the area of the semicircular region is 8π , what is the perimeter of the shape?



- A. $16 + 8\pi$ B. $24 + 4\pi$ C. $12 + 8\pi$ D. $24 + 4\pi^2$ E. $16 + 4\pi^2$

Answer: B

The area of the semicircle is given by $\frac{1}{2} \pi r^2$, so

$$\frac{1}{2} \pi r^2 = 8\pi$$

$$\pi r^2 = 16\pi$$

$$r^2 = \frac{16\pi}{\pi} = 16$$

$$r = \sqrt{16} = 4$$

The side of the square is the diameter of the semicircle which is 8. Half of the circumference of the circle $= \frac{\pi d}{2} = \frac{\pi \cdot 8}{2} = 4\pi$. Perimeter $= 3(8) + 4\pi = 24 + 4\pi$.

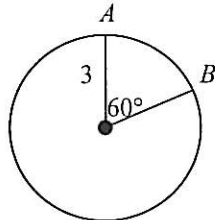
50. If $f(x) = x^2 - 5$ and $g(x) = 5x$, what is the value of $f(g(3)) - g(f(3))$?

- F. 400 G. 240 H. 200 J. 40 K. 0

Answer: H

$f(x) = x^2 - 5$ and $g(x) = 5x$ then $f(g(3)) = f(5(3)) = f(15) = 15^2 - 5 = 220$ and $g(f(3)) = g(3^2 - 5) = g(4) = 5(4) = 20$. So $f(g(3)) - g(f(3)) = 220 - 20 = 200$.

51. What is the length of the arc AB ?



- A. π B. 2π C. 2.5π D. 3π E. 6π

Answer: A

The angle occupied by the sector $= \frac{60}{360} = \frac{1}{6}$ of the whole circle. So the length of arc $AB = \frac{1}{6}$ of the circumference of the circle $= \frac{1}{6} \cdot \pi d = \frac{1}{6} \cdot \pi \cdot 6 = \pi$.

52. If two sides of a triangle are 6 cm and 8 cm, which of these could be the third side?

- F. 1 G. 2 H. 7 J. 14 K. 15

Answer: H

Let the third side be x . By the triangular inequality,

$$6 + 8 > x \quad \text{and} \quad x + 6 > 8 \quad \text{and} \quad x + 8 > 6.$$

$$14 > x \quad \text{and} \quad x > 2 \quad \text{and} \quad x > -2$$

$$x < 14 \quad \text{and} \quad x > 2 \quad \text{no conclusion}$$

$$\text{So } 2 < x < 14$$

53. If $x = 4$ is a solution of the equation $x^2 + kx - 24 = 0$, what is the value of k ?

- A. -6 B. -2 C. 2 D. 4 E. 6

Answer: C

$$4^2 + k(4) - 24 = 0$$

$$16 + 4k - 24 = 0$$

$$4k - 8 = 0$$

$$4k = 8 \qquad k = 2$$

54. Which of the following is not a solution for $|5 - 2x| \geq 3$?

- F. -2 G. -1 H. 0 J. 2 K. 5

Answer: J

By substitution, $x = 2$ is not a solution since $x = 2 \Rightarrow |5 - 2(2)| \geq 3 \Rightarrow |5 - 4| \geq 3 \Rightarrow 1 \geq 3$ is false.

55. Which of the following forms an identity with $\frac{\tan x}{\sec x}$?

- A. $\sin x$ B. $\frac{\sin x}{\cos^2 x}$ C. $\frac{\sin^2 x}{\cos x}$ D. $\cot x$ E. $\frac{1}{\sin x}$

Answer: A

Since $\tan x = \frac{\sin x}{\cos x}$ and $\sec x = \frac{1}{\cos x}$, then $\frac{\tan x}{\sec x} = \frac{\frac{\sin x}{\cos x}}{\frac{1}{\cos x}} = \frac{\sin x}{\cos x} \div \frac{1}{\cos x} = \frac{\sin x}{\cos x} \cdot \frac{\cos x}{1} = \sin x$

56. $\frac{7}{2 - \sqrt{3}} = ?$

- F. $14 + 7\sqrt{3}$ G. $-7\sqrt{3}$ H. $21\sqrt{3}$ J. $\frac{14 - 7\sqrt{3}}{-5}$ K. $14\sqrt{3} - 5$

Answer: F

Multiplying the numerator and denominator of $\frac{7}{2 - \sqrt{3}}$ by $(2 + \sqrt{3})$ we have

$$\frac{7}{2 - \sqrt{3}} \cdot \frac{(2 + \sqrt{3})}{(2 + \sqrt{3})} = \frac{7(2 + \sqrt{3})}{4 - (\sqrt{3})^2} = \frac{7(2 + \sqrt{3})}{4 - 3} = 7(2 + \sqrt{3}) = 14 + 7\sqrt{3}$$

57. The roots of $2x^2 + 13x + 18 = 0$ are which of the following?

- I. rational II. irrational III. imaginary

- A. I only B. II only C. I and II only D. II and III only E. I, II, and III

Answer: A

$2x^2 + 13x + 18 = 0$ Let's examine the discriminant $b^2 - 4ac$, $b^2 - 4ac = 13^2 - 4(2)(18) = 169 - 144 = 25$. Since $b^2 - 4ac$ has an exact square root (5), the roots are rational.

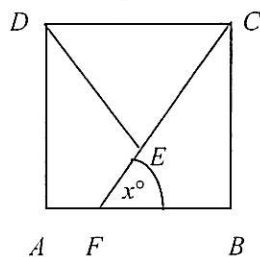
58. $8^{\frac{2}{3}} \cdot 2^{-1} = ?$

- F. $\frac{1}{16}$ G. $\frac{1}{2}$ H. 2 J. 4 K. 16

Answer: H

$$8^{\frac{2}{3}} \cdot 2^{-1} = (\sqrt[3]{8})^2 \cdot \frac{1}{2^1} = 2^2 \cdot \frac{1}{2} = 4 \cdot \frac{1}{2} = 2$$

59. If $ABCD$ is a square and CDE is an equilateral triangle, what is the value of x ?

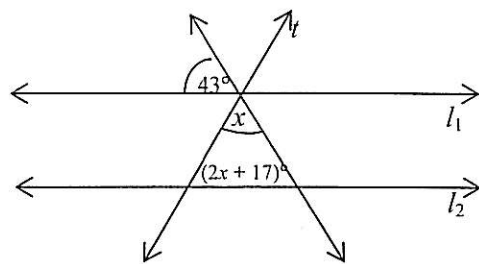


- A. 30° B. 40° C. 45° D. 50° E. 60°

Answer: E

$\triangle CDE$ is equilateral; each interior angle = 60° . $ABCD$ is a square; each interior angle = 90° . So $m\angle ECB = 90^\circ - 60^\circ = 30^\circ$, but $\angle CBF = 90^\circ$ so $x + 30^\circ + 90^\circ = 180^\circ$ (sum of \angle s in $\triangle CBF$) $x = 180^\circ - 120^\circ = 60^\circ$

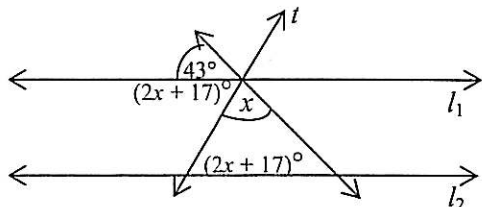
60. In the figure below, $l_1 \parallel l_2$ and t is a transversal. What is the value of x ?



- F. 40° G. 42.5° H. 43° J. 46.5° K. 60°

Answer: F

$(2x + 17)^\circ$ is equal to its interior alternate pair as shown in the diagram.



$43 + 2x + 17 + x = 180^\circ$, sum of the angles in a straight angle, so

$$\begin{aligned} 3x + 60 &= 180 \\ 3x &= 120 \\ x &= 40 \end{aligned}$$