HASOOLEILM TUITION ACADEMY

Topic 8: Vectors

Instructions: Circle the letter of the BEST answer. Each correct answer = 1 mark. Time: 20 minutes.

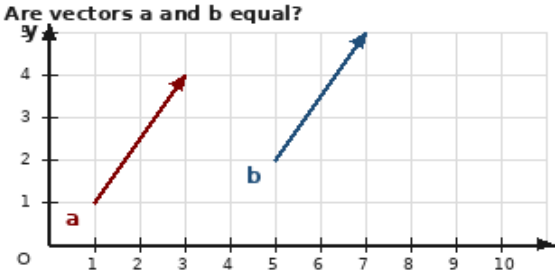
1. In the rectangular (Cartesian) coordinate system, the x-axis and y-axis are:

A. Parallel to each other
B. Perpendicular to each other
C. At 45° to each other
D. Along the same line

2. A point lies in the third quadrant of the Cartesian plane. Which sign combination is correct for its coordinates (x, y)?

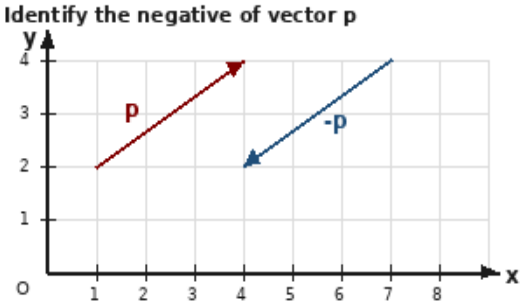
A. (+, +)
B. (+, −)
C. (−, +)
D. (−, −)

3. Vector a = (2, 3) starts at (1, 1) and vector b = (2, 3) starts at (5, 2). Are these vectors equal?



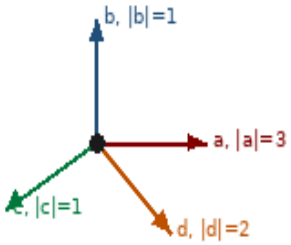
A. No — equal vectors must start at the same point
B. Yes — starting point does not matter
C. No — they are parallel but not equal
D. Yes — only if their magnitudes are equal

4. Vector p goes from A to B. Which statement correctly describes −p?



A. −p has the same direction as p but twice the magnitude
B. −p has the same magnitude as p but points in the opposite direction
C. −p is a zero vector
D. −p is perpendicular to p

5. Looking at the four vectors shown, which are unit vectors?

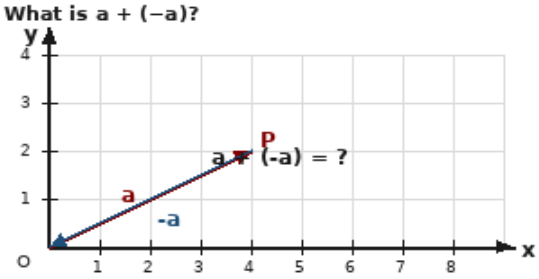


A. Only a, since it points along the x-axis
B. Both b and c, since |b| = |c| = 1
C. All four vectors are unit vectors
D. Only d, since it is the longest

6. A unit vector in the direction of v = (3, 4) is obtained by:

A. Dividing v by its magnitude: $\hat{v} = (3/5, 4/5)$
B. Multiplying v by its magnitude: $\hat{v} = (15, 20)$
C. Subtracting 1 from components: $\hat{v} = (2, 3)$
D. Squaring each component: $\hat{v} = (9, 16)$

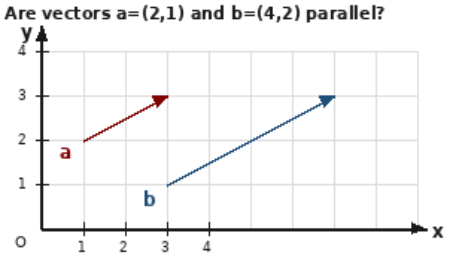
7. What is the result of a + (−a) for any vector a?



A. 2a
B. (0, 0)
C. A unit vector
D. −2a

8. The position vector of point P(4, 3) is drawn from the origin O. Which of the following is the correct position vector OP?

A. OP = (3, 4)
B. OP = (−4, −3)
C. OP = (4, 3)
D. OP = (4, −3)

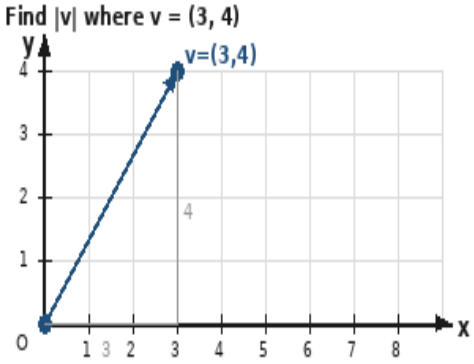
9. 

A. No — they have different magnitudes
B. Yes — b = 2a
C. No — parallel vectors must be equal in magnitude
D. Yes — both vectors have positive components

10. Vector p = (3, 6) and vector q = (1, 2). Which statement is true?

A. p and q are equal vectors
B. p and q are perpendicular
C. p = 3q, so p and q are parallel vectors
D. p and q are unit vectors

11. Vector v = (3, 4) is shown on the grid. What is |v|?



A. |v| = 7
B. |v| = 5
C. |v| = 25
D. |v| = √7

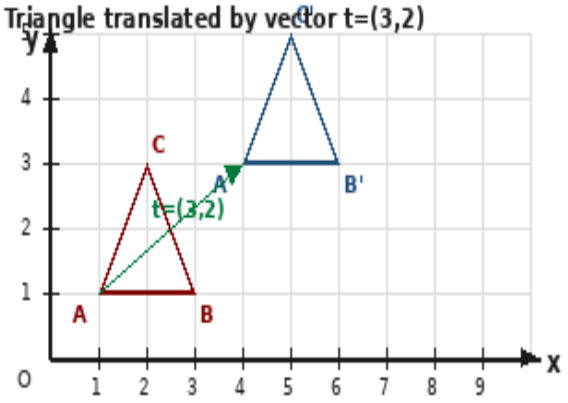
12. Find the magnitude of vector w = (−5, 12).

A. |w| = 7
B. |w| = 13
C. |w| = 17
D. |w| = 119

13. Two vectors u = (6, 8) and v = (3, 4). Compare their magnitudes.

A. |u| = 10, |v| = 5, so |u| = 2|v|
B. |u| = 14, |v| = 7, so |u| = 2|v|
C. |u| = |v| = 10
D. |u| = 100, |v| = 25

14. Triangle ABC is translated by vector t = (3, 2) to form triangle A'B'C'. If A = (1, 1), what are the coordinates of A'?



A. A' = (3, 2)
B. A' = (4, 3)
C. A' = (−2, −1)
D. A' = (2, 3)

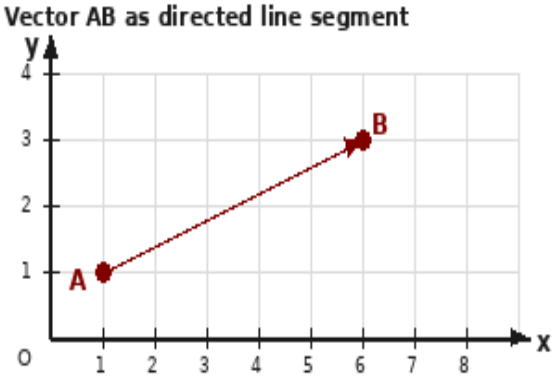
15. A point P(5, 7) is translated by vector t = (−3, 4). What are the new coordinates P'?

A. P' = (2, 11)
B. P' = (8, 3)
C. P' = (−3, 4)
D. P' = (2, 3)

16. Point Q' = (7, 5) is the image of Q after a translation by t = (4, −2). What are the original coordinates of Q?

A. Q = (11, 3)
B. Q = (3, 7)
C. Q = (7, 2)
D. Q = (4, −2)

17. Vector AB is drawn from A(1,1) to B(6,3) on the grid. What is the component form of vector AB?



A. AB = (1, 1)
B. AB = (5, 2)
C. AB = (7, 4)
D. AB = (−5, −2)

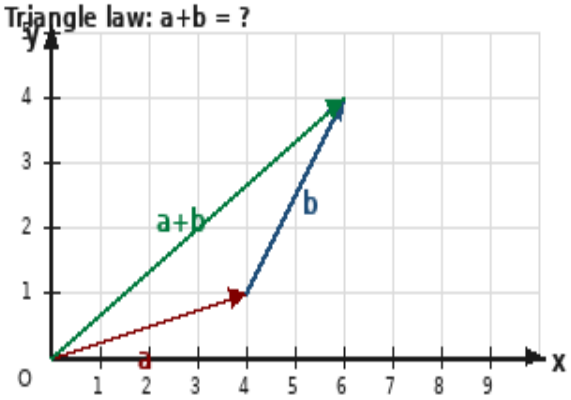
18. Vector BA is the directed segment from B(6,3) back to A(1,1). How does BA relate to AB?

A. BA = AB
B. BA = −AB = (−5, −2)
C. BA = 2AB
D. BA is perpendicular to AB

19. Which of the following correctly represents a directed line segment vector from O(0,0) to P(−3, 5)?

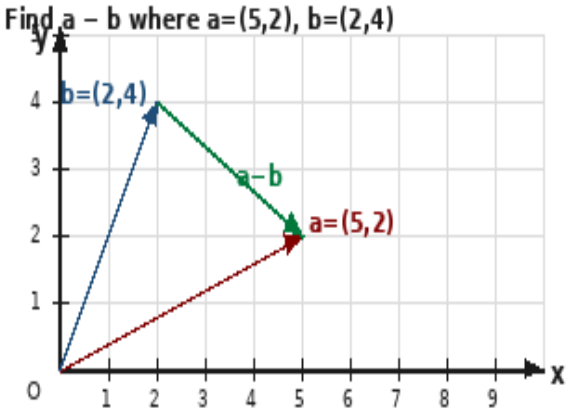
A. OP = (3, −5), pointing left and down
B. OP = (−3, 5), pointing left and up
C. OP = (5, −3)
D. OP = (0, 0)

20. Using the triangle law shown, a = (4,1) and b = (2,3). Find a + b.



A. (2, −2)
B. (6, 4)
C. (8, 3)
D. (6, 2)

21. Vectors a = (5, 2) and b = (2, 4) are shown. Find a − b.



A. (3, −2)
B. (7, 6)
C. (−3, 2)
D. (3, 2) [incorrect sign trap]

22. If p = (−2, 5) and q = (4, −3), find p + q and |p + q|.

A. p+q = (2,2), |p+q| = 2√2
B. p+q = (6,8), |p+q| = 10
C. p+q = (−6,8), |p+q| = 10
D. p+q = (2,2), |p+q| = 4

23. Using the parallelogram law, p = (4, 0) and q = (0, 3). The resultant p + q has magnitude:

A. 7
B. 5 (√(4²+3²) = 5)
C. 12
D. 1

24. Vectors u = (3, −1) and v = (−3, 1). Find u + v and state what type of vector the result is.

A. u+v = (6, −2), a parallel vector
B. u+v = (0, 0), the zero/null vector — u and v are negatives of each other
C. u+v = (0, 2), a unit vector
D. u+v = (−6, 2), a position vector

25. Vector a = (2, 1). From the figure, find 2a and −a.

A. 2a = (4, 2), −a = (−2, −1)
B. 2a = (4, 2), −a = (2, 1)
C. 2a = (2, 2), −a = (−1, −2)
D. 2a = (1, 0.5), −a = (−2, 1)

26. If v = (−3, 6), find (1/3)v.

A. (1/3)v = (−1, 2)
B. (1/3)v = (−9, 18)
C. (1/3)v = (3, −6)
D. (1/3)v = (−3, 2)

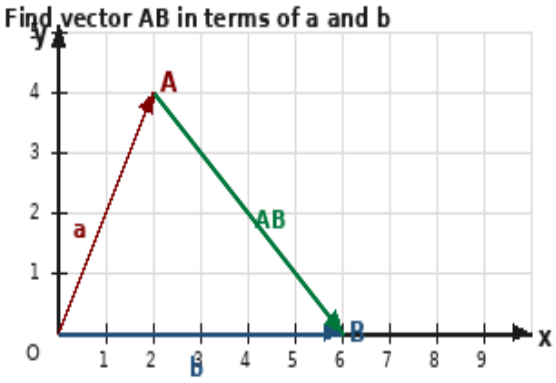
27. Scalar k = −2 and vector u = (3, −4). Find ku and |ku|.

A. ku = (−6, 8), |ku| = 10
B. ku = (6, −8), |ku| = 10
C. ku = (−6, 8), |ku| = 14
D. ku = (1, −2), |ku| = √5

28. Vectors a = (2, 3) and b = (4, 6). Express b in terms of a.

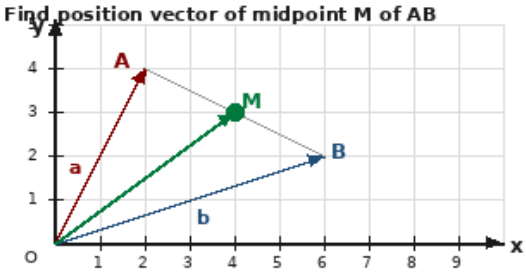
A. b = a + (2, 3)
B. b = 2a, so b is a scalar multiple of a (parallel to a)
C. b = a²
D. b = a − (2, 3)

29. In the triangle OAB, OA = a and OB = b. Find vector AB in terms of a and b.



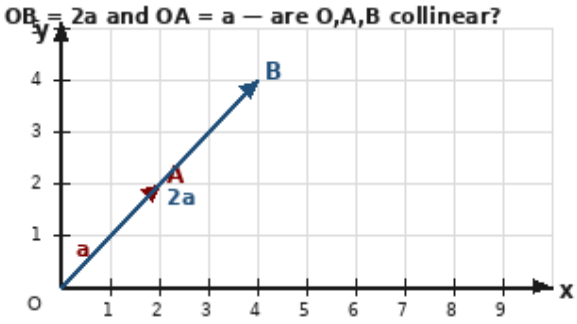
A. AB = a + b
B. AB = b − a (AB = AO + OB = −a + b)
C. AB = a − b
D. AB = 2a − b

30. OA = a and OB = b. M is the midpoint of AB. Find the position vector OM.



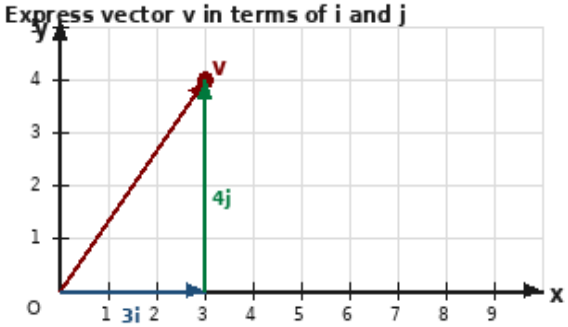
A. OM = a + b
B. OM = ½(a − b)
C. OM = ½(a + b)
D. OM = 2(a + b)

31. OA = a and OB = 2a. What can you conclude about points O, A and B?



A. O, A, B are collinear — OB is a scalar multiple of OA, so all three lie on the same line
B. O, A, B form a right-angled triangle
C. OA and OB are perpendicular
D. O, A, B cannot be determined without coordinates

32. Vector v is shown on the grid with horizontal component 3 and vertical component 4. Express v using unit vectors i and j.



A. v = 4i + 3j
B. v = 3i + 4j
C. v = 3i − 4j
D. v = 7i

33. If a = 2i − 3j and b = −i + 5j, find a + b and a − b.

A. a+b = i+2j, a−b = 3i−8j
B. a+b = 3i+2j, a−b = i−8j
C. a+b = i−2j, a−b = 3i+8j
D. a+b = i+2j, a−b = i+8j

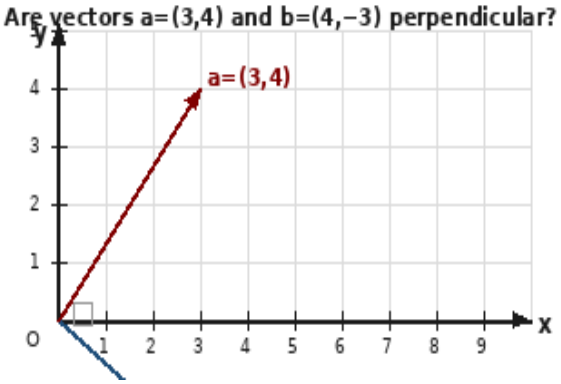
34. Vector p = 5i − 12j. Find |p|.

A. |p| = 17
B. |p| = 13 (√(25+144) = √169 = 13)
C. |p| = 7
D. |p| = 119

35. If 3(ai + bj) = 12i − 9j, find a and b.

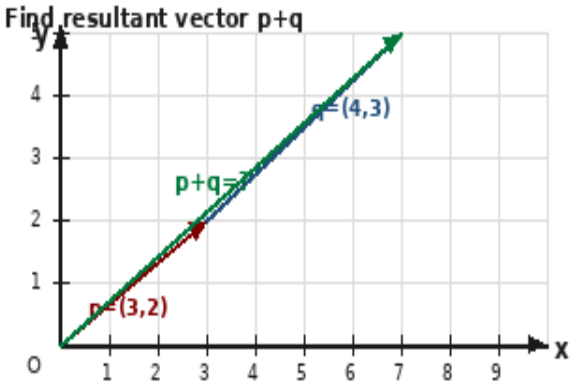
A. a = 4, b = −3
B. a = 36, b = −27
C. a = 3, b = 4
D. a = −3, b = 4

36. Vectors a = (3, 4) and b = (4, −3) are shown. Using dot product, a·b = 3×4 + 4×(−3). Are they perpendicular?



A. No — their magnitudes are different
B. Yes — a·b = 12 − 12 = 0, so a and b are perpendicular
C. No — perpendicular vectors must be unit vectors
D. Yes — they point in different directions

37. Vectors p = (3, 2) and q = (4, 3) are placed head-to-tail. Find the resultant vector p + q and its magnitude.



A. p+q = (7, 5), |p+q| = √74
B. p+q = (12, 6), |p+q| = √180
C. p+q = (1, 1), |p+q| = √2
D. p+q = (7, 5), |p+q| = 12

38. Points A, B, C have position vectors a = 2i + j, b = 5i + 4j, c = 8i + 7j. Show whether A, B, C are collinear.

A. AB = 3i+3j and BC = 3i+3j — AB = BC so AB ∥ BC and share point B; A,B,C are collinear
B. AB = 3i+3j and BC = 3i+3j — they are equal vectors but the points are NOT collinear
C. AB = 7i+5j; A,B,C are not collinear
D. You cannot determine collinearity from position vectors alone

Best of luck!