MATHEMATICS

Mob. : 9470844028
9546359990

AIM POINTS
MATHEMATICS
DIR. FIROZ AHMAD

Ram Rajya More, Siwan

XIth, XIIth, TARGET IIT-JEE (MAIN + ADVANCE) & COMPETITIVE EXAM. FOR XII (PQRS)

SCALAR OR DOT PRODUCT

& Their Properties

CONTENTS

THINGS TO REMEMBER

1. If $\vec{a}$ and $\vec{b}$ are two non-zero vectors inclined at an angle θ, then

(i) $\vec{a}\cdot\vec{b} = |\vec{a}|\,|\vec{b}|\cos\theta$

(ii) Projection of $\vec{a}$ on $\vec{b} = \frac{\vec{a}.\vec{b}}{|\vec{b}|} = \vec{a}\cdot\hat{b}$

(iii) Projection of $\vec{b}$ on $\vec{a} = \frac{\vec{a}.\vec{b}}{|\vec{b}|} = \vec{b}\cdot\hat{a}$

(iv) Projection of $\vec{a}$ on $\vec{b} = \left\{\frac{\vec{a}.\vec{b}}{|\vec{b}|}\right\}\hat{b} = \left\{\frac{\vec{a}.\vec{b}}{|\vec{b}|^2}\right\}\vec{b}$

(v) Projection vector $\vec{b}$ on $\vec{a} = \left\{\frac{\vec{a}.\vec{b}}{|\vec{b}|}\right\}\hat{a} = \left\{\frac{\vec{a}.\vec{b}}{|\vec{b}|^2}\right\}\vec{a}$

(vi) $\vec{a}\cdot\vec{b} = 0 \Rightarrow \vec{a}$ is perpendicular to $\vec{b}$.

(vii) $\vec{a}\cdot\vec{b} = \vec{b}\cdot\vec{a}$

(viii) $\vec{a}\cdot\vec{a} = |\vec{a}|^2$

(ix) $m\vec{a}\cdot\vec{b} = m(\vec{a}\cdot\vec{b}) = \vec{a}, m\vec{b}$, for scalar m

(x) $m\vec{a}.n\vec{b} = mn(\vec{a}\cdot\vec{b}) = mn(\vec{a}\cdot\vec{b}) = \vec{a}.mn\vec{b}$ for scalars m, n

(xi) $|\vec{a} \pm \vec{b}| \le |\vec{a}| + |\vec{b}|$

(xii) $|\vec{a} \square - \vec{b}| \ge |\vec{a}| - |\vec{b}|$

(xiii) $|\vec{a} \square + \vec{b}|^2 \ge |\vec{a}|^2 - |\vec{b}|^2 \pm 2(\vec{a}\cdot\vec{b})$

(xiv) $(\vec{a}+\vec{b}).(\vec{a}-\vec{b}) = |\vec{a}|^2 - |\vec{b}|^2$

(xv) $\vec{a}\cdot\vec{b} > 0$ if θ is acute

(xvi) $\vec{a}\cdot\vec{b} < 0$ if θ is obtuse

2. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors, then $\vec{a}\cdot\vec{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$

$|\vec{a}+\vec{b}+\vec{c}|^2 = |\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2 + 2(\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a})$

3. If $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ and $\vec{b} = b_1\hat{i} + b_2\hat{j} + b_3\hat{k}$, then $\vec{a}\cdot\vec{b} = a_1b_1 + a_2b_2 + a_3b_3$.

4. If $\vec{a}$ and $\vec{b}$ are two vectors inclined at an angle θ, then $\cos\theta = \frac{\vec{a}.\vec{b}}{|\vec{a}|\,|\vec{b}|}$

5. If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar vectors in space and $\vec{r}$ is any vector in space, then $\vec{r} = (\vec{r}\cdot\hat{a})\,\hat{a} + (\vec{r}\cdot\hat{b})\,\hat{b} + (\vec{r}\cdot\hat{c})\hat{c}$

   where $\hat{a}, \hat{b}, \hat{c}$ are unit vectors in the directions of $\vec{a}, \vec{b}, \vec{c}$ respectively.

   Also, $\vec{r} = \left\{\dfrac{\vec{r}.\vec{a}}{|\vec{a}|^2}\right\}\vec{a} + \left\{\dfrac{\vec{r}.\vec{b}}{|\vec{b}|^2}\right\}\vec{b} + \left\{\dfrac{\vec{r}.\vec{c}}{|\vec{b}|^2}\right\}\vec{c}$

   In particular, $\vec{r} = (\vec{r}.\hat{i})\,\hat{i} + (\vec{r}.\hat{j})\hat{j} + (\vec{r}.\hat{k})\hat{k}$.

EXERCISE-1

1. The scalar product of two vectors is commutative i.e. $\vec{a}\cdot\vec{b} = \vec{b}\cdot\vec{a}$.

2. For any two vectors $\vec{a}$ and $\vec{b}$, we have

   (i) $|\vec{a}+\vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 + 2\vec{a}\cdot\vec{b}$

   (ii) $|\vec{a}-\vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 - 2\vec{a}\cdot\vec{b}$

   (iii) $(\vec{a}+\vec{b}).(\vec{a}-\vec{b}) = |\vec{a}|^2 - |\vec{b}|^2$

3. Find $\vec{a}\cdot\vec{b}$ when,

   (i) $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = 6\hat{i} - 3\hat{j} + 2\hat{k}$

   (ii) $\vec{a} = (1, 1, 2)$ and $\vec{b} = (3, 2, -1)$

4. Find $(\vec{a}+3\vec{b}).(2\vec{a}-\vec{b})$, if $\vec{a} = \hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - \hat{k}$.

5. For any vector $\vec{r}$, prove that $\vec{r} = (\vec{r}\cdot\hat{i})\hat{i} + (\hat{i}.\hat{j})\,\hat{j} + (\vec{r}.\hat{k})\hat{k}$.

6. Dot products of a vector with vectors $3\hat{i} - 5\hat{k}$, $2\hat{i} + 7\hat{j} + \hat{k}$ are respectively –1, 6 and 5. Find the vector.

7. Find the value of λ so that the vector $\vec{a} = 2\hat{i} + \lambda\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ are perpendicular to each other.

8. Find the value of p for which the vector $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are

   (i) perpendicular

   (ii) Parallel.

9. Find the angle between two vector $\vec{a}$ and $\vec{b}$ having the same length $\sqrt{2}$ and their sealar product is –1.

10. Find the angle between the vectors $5\hat{i} + 3\hat{j} + 4\hat{k}$ and $6\hat{i} - 8\hat{j} - \hat{k}$.

11. If $\hat{i}+\hat{j}+\hat{k}$, $2\hat{i}+5\hat{j}$, $3\hat{i}+2\hat{j}-3\hat{k}$ and $\hat{i}-6\hat{j}-\hat{k}$ respectively are the position vectors of pointing A, B, C and D, then find the angle between the straight lines AB and CD. Deduce that AB and CD are collinear.

12. Find the projection of the vector $7\hat{i}+\hat{j}-4\hat{k}$ on $2\hat{i}+6\hat{j}+3\hat{k}$.

13. Show that the projection vector of $\vec{a}$ on $\vec{b}$ $(\neq\vec{0})$ (component of $\vec{a}$ along $\vec{b}$) is $\left(\frac{\vec{a}.\vec{b}}{|\vec{b}|}\right)\vec{b}$.

14. Show that the projection vector of $\vec{b}$ on $\vec{a}\neq 0$ is $\left(\frac{\vec{a}.\vec{b}}{|\vec{a}|^2}\right)\vec{a}$.

15. For any two vectors $\vec{a}$ and $\vec{b}$, prove that :

    (i) $|\vec{a}+\vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 + 2\vec{a}\cdot\vec{b}$

    (ii) $|\vec{a}-\vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 - 2\vec{a}\cdot\vec{b}$

    (iii) $|\vec{a}+\vec{b}|^2 + |\vec{a}-\vec{b}|^2 = 2(|\vec{a}|^2 + |\vec{b}|^2)$

    Interpret the result geometrically. :

    (iv) $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}| \Rightarrow \vec{a}\perp\vec{b}$

    Interpret the result geometrically. :

    (v) $|\vec{a}+\vec{b}| = |\vec{a}| + |\vec{b}| \Rightarrow \vec{a}$ is parallel to $\vec{b}$

    (vi) $|\vec{a}+\vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 \Rightarrow \vec{a}, \vec{b}$ are orthogonal.

16. For any two vectors $\vec{a}$ and $\vec{b}$, prove that $|\vec{a}+\vec{b}| \leq |\vec{a}| + |\vec{b}|$

17. Prove Cauchy-Schawarz inequality $(\vec{a}\cdot\vec{b})^2 \leq |\vec{a}|^2\,|\vec{b}|^2$

18. If two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 2$, $|\vec{b}| = 1$ and $\vec{a}\cdot\vec{b} = 1$, find $(3\vec{a}-5\vec{b}).(3\vec{a}+7\vec{b})$.

19. Find $|\vec{x}|$, if for a unit vector $\vec{a}$, $(\vec{x}-\vec{a}).(\vec{x}+\vec{a}) = 15$.

20. The scalar product of the vector $\hat{i}+\hat{j}+\hat{k}$ with a unit vector along the sum of the vectors $2\hat{i}+4\hat{j}-5\hat{k}$ and $\lambda\hat{i}+2\hat{j}+3\hat{k}$ is equal to 1. Find the value of λ.

21. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $|\vec{c}| = 7$, find the angle between $\vec{a}$ and $\vec{b}$.

22. If $\vec{a}=5\hat{i}-\hat{j}-3\hat{k}$, and $\vec{b}=\hat{i}+3\hat{j}-5\hat{k}$, then show that the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are prepcndicular.

23. Two vector $\vec{a}$ and $\vec{b}$, prove that the vector $|\vec{a}|\,\vec{b}+|\vec{b}|\vec{a}$ is orthogonal to the vector $|\vec{a}|\,\vec{b}-|\vec{b}|\vec{a}$.

24. Show that the vectors $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$, $3\hat{i}-4\hat{j}-4\hat{k}$ form the sides of a right angled triangle.

25. Find the value of x for which the angle between the vectors $\vec{a}=2x^2\hat{i}+4x\hat{j}+\hat{k}$ and $\vec{b}=7\hat{i}-2\hat{j}+x\hat{k}$ is obtuse.

26. Find the value of a for which the vectors $\vec{a}=(c\log_2 x)\hat{i}-6\hat{j}+3\hat{k}$ and $\vec{b}=(\log_2 x)\hat{i}+2\hat{j}+(2c\log_2 x)\hat{k}$ make an abtuse angle for any $x \in (0, \infty)$.

27. If $\vec{a},\vec{b}$ are two vectors such that $|\vec{a}+\vec{b}| = |\vec{a}|$, then prove that $2\vec{a}+\vec{b}$ is prependicular to $\vec{b}$.

28. If $\vec{a},\vec{b},\vec{c}$ are three mutually prependicular vectors of equal magnitude, prove that $\vec{a}+\vec{b}+\vec{c}$ is equally inclined with vectors $\vec{a},\vec{b}$ and $\vec{c}$.

29. Let $\vec{a},\vec{b},\vec{c}$ be three vectors of magnitudes 3, 4 and 5 respectively. If each one is perpendicular to the sum of the other two vectors, prove that $|\vec{a}+\vec{b}+\vec{c}| = 5\sqrt{2}$.

30. If $\vec{a},\vec{b},\vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, find the value of $\vec{a}\cdot\vec{b}\cdot\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$.

31. Three vectors $\vec{a},\vec{b}$ and $\vec{c}$ satisfy the condition $\vec{a}+\vec{b}+\vec{c}=\vec{0}$. Evaluate the quantity $\mu-\vec{a}\cdot\vec{b}\cdot\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$, if $|\vec{a}| = 1$, $|\vec{b}| = 4$ and $|\vec{c}| = 2$.

32. Dot product of a vector with $\hat{i}+\hat{j}-3\hat{k}$, $\hat{i}+3\hat{j}-2\hat{k}$ and $2\hat{i}+\hat{j}+4\hat{k}$ are C, 5 and 8 respectively. Find the vector.

33. If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle θ, then prove that

(i) $\cos\frac{\theta}{2}=\frac{1}{2}|\hat{a}+\hat{b}|$

(ii) $\tan\frac{\theta}{2}=\frac{|\hat{a}-\hat{b}|}{|\hat{a}+\hat{b}|}$

34. If $\vec{a},\vec{b},\vec{c}$ are three mutually perpendicular unit vectors, then prove that $|\vec{a}+\vec{b}+\vec{c}| = \sqrt{3}$.

35. Show that the vectors $\vec{a}=\frac{1}{7}(2\hat{i}+3\hat{j}+6\hat{k})$, $\vec{b}=\frac{1}{7}(3\hat{i}-6\hat{j}+2\hat{k})$, $\vec{c}=\frac{1}{7}(6\hat{i}+2\hat{j}+3\hat{k})$ are mutually perpendicular unit vectors.

36. If $|\vec{a}| = a$ and $|\vec{b}| = b$, prove that $\left(\frac{\vec{a}}{a_2}-\frac{\vec{b}}{b_2}\right)=\left(\frac{\vec{a}-\vec{b}}{ab}\right)$.

37. Show that the vectors $\vec{a}=3\hat{i}-2\hat{j}+\hat{k}$, $\vec{b}=\hat{i}-3\hat{j}+5\hat{k}$, $\vec{c}=2\hat{i}+\hat{j}-4\hat{k}$ form a right angled triangle.

38. If $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, show that the angle θ between the vectors $\vec{b}$ and $\vec{c}$ is given by

$$\cos\theta = \frac{|\vec{a}|^2-|\vec{b}|^2-|\vec{c}|^2}{2|\vec{b}||\vec{c}|}.$$

39. Let $\vec{u}, \vec{v}$ and $\vec{w}$ be vector such $\vec{u}+\vec{v}+\vec{w}=\vec{0}$. If $|\vec{u}| = 3$, $|\vec{v}| = 4$ and $|\vec{w}| = 5$, then find $\vec{u}\cdot\vec{v}+\vec{v}\cdot\vec{w}+\vec{w}\cdot\vec{u}$.

40. Show that the points whose position vectors are $\vec{a} = 4\hat{i}-3\hat{j}+\hat{k}$, $\vec{b} = 2\hat{i}-4\hat{j}+5\hat{k}$, $\vec{c} = \hat{i}-\hat{j}$ form a right triangle.

41. Evaluate : $(3\vec{a}-5\vec{b})\cdot(2\vec{a}+\vec{b})$

42. If $\vec{a}$ is a unit vector, then find $|\vec{x}|$ in each of the following :
    (i) $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a}) = 8$
    (ii) $(\vec{x}-\vec{a})\cdot(\vec{x}+\vec{a}) = 12$

43. Find $|\vec{a}|$ and $|\vec{b}|$, if
    (i) $(\vec{a}+\vec{b})\cdot(\vec{a}-\vec{b}) = 12$ and $|\vec{a}| = 2|\vec{b}|$
    (ii) $(\vec{a}+\vec{b})\cdot(\vec{a}-\vec{b}) = 8$ and $|\vec{a}| = 8|\vec{b}|$
    (iii) $(\vec{a}+\vec{b})\cdot(\vec{a}-\vec{b}) = 3$ and $|\vec{a}| = 2|\vec{b}|$

44. Find the angle between two vectors $\vec{a}$ and $\vec{b}$, if
    (i) $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 2$ and $\vec{a}\cdot\vec{b} = \sqrt{6}$
    (ii) $|\vec{a}| = 3$, $|\vec{b}| = 3$ and $\vec{a}\cdot\vec{b} = 4$

45. Express the vector $\vec{a} = 5\hat{i}-2\hat{j}+5\hat{k}$ as the sum of two vectors such that one is parallel to the vector $\vec{b} = 3\hat{i}+\hat{k}$ and other is prependicular to $\vec{b}$.

46. If $\vec{a}$ and $\vec{b}$ are two vectors of the same magnitude inclined at an angle of 30° such that $\vec{a}\cdot\vec{b} = 3$, find $|\vec{a}|$, $|\vec{b}|$.

47. Decompose the vector $6\hat{i}-3\hat{j}-6\hat{k}$ into vectors which are parallel and prependicular to the vector $\hat{i}+\hat{j}+\hat{k}$.

48. If $\vec{a}\cdot\vec{a} = 0$ and $\vec{a}\cdot\vec{b} = 0$, what can you conlude about the vector $\vec{b}$?

49. A unit vector $\vec{a}$ makes angles $\frac{\pi}{2}$ and $\frac{\pi}{3}$ with $\hat{i}$ and $\hat{j}$ respectively and an acute angle θ with $\hat{k}$. Find the angle θ and component of $\vec{a}$.

50. If $\vec{a} = 5\hat{i}-\hat{j}-3\hat{k}$ and $\vec{b} = \hat{i}+3\hat{j}-5\hat{k}$, then show that the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are orthogonal.

51. Find the projection of $\vec{b}+\vec{c}$ on $\vec{a}$, where $\vec{a} = 2\hat{i}-2\hat{j}+\hat{k}$, $\vec{b} = \hat{i}+2\hat{j}-2\hat{k}$ and $\vec{c} = 2\hat{i}-\hat{j}+4\hat{k}$.

52. Find the magnitude of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude and such that the angle between them is 60° and their scalar product is 1/2.

53. If $\vec{a} = 2\hat{i}-2\hat{j}+3\hat{k}$, $\vec{b}=-\hat{i}+2\hat{j}+\hat{k}$ and $\vec{c}= 3\hat{i}+\hat{j}$ are such that $\vec{a}+\lambda\vec{b}$ is perpendicular to c, then find the value of λ.

54. If either $\vec{a}=\vec{0}$ or $\vec{b}=\vec{0}$, then $\vec{a}\cdot\vec{b}= 0$. But the converse need not be true. Justify your answer with an example.

EXERCISE-2

1. What is the angle between vector $\vec{a}$ and $\vec{b}$ with magnitudes 2 and $\sqrt{3}$ respectively ? Given $\vec{a}\cdot\vec{b}=\sqrt{3}$.
2. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}\cdot\vec{b}= 6$, $|\vec{a}| = 3$ and $|\vec{b}| = 4$. Write the projection of $\vec{a}$ on $\vec{b}$.
3. If the vectors $3\hat{i}-2\hat{j}-4\hat{k}$ and $18\hat{i}-12\hat{j}-m\hat{k}$ are parallel, find the value of m.
4. For any two vector $\vec{a}$ and $\vec{b}$ write when $|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$ holds.
5. If $\vec{a},\vec{b}$ are unit vectors such that $\hat{a}+\hat{b}$ is a unit vector, write the value of $|\hat{a}-\hat{b}|$.
6. If $|\vec{a}| = 2$, $|\vec{b}| = 5$ and $\vec{a}\cdot\vec{b}= 2$, find $|\vec{a}-\vec{b}|$.
7. For any two non-zero vector, write the value of $\dfrac{|\vec{a}+\vec{b}|^2+|\vec{a}-\vec{b}|^2}{|\vec{a}|^2+|\vec{b}|^2}$.
8. Find the value of $\theta \in (\theta, \pi/2)$ for which vectors $\vec{a}= (\sin\theta)\ \hat{i}+(\cos\theta)\hat{j}$ and $\vec{b}=\hat{i}-\sqrt{3}\ \hat{j}+2\hat{k}$ are perpendicular.
9. If $\vec{a}$ and $\vec{b}$ are matually perpendicular unit vector, write the value of $|\vec{a}+\vec{b}|$.
10. Find the angle between the vectors $\vec{a}=\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}-\hat{k}$.
11. For what value of λ are the vectors $\vec{a}=2\hat{i}+\lambda\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+3\hat{k}$ perpendicular to each other ?
12. Find the projection of $\vec{a}$ on $\vec{b}$ if $\vec{a}\cdot\vec{b} = 8$ and $\vec{b}=2\hat{i}+6\hat{j}+3\hat{k}$.
13. Write the value of p for which $\vec{a}=3\hat{i}+2\hat{j}+9\hat{k}$ and $\vec{b}=\hat{i}+p\hat{j}+3\hat{k}$ are parallel vectors.
14. Find the value of λ if the vectors $2\hat{i}+\lambda\hat{j}+3\hat{k}$ and $3\hat{i}+2\hat{j}-4\hat{k}$ are perpendicular to each other.
15. If $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a}\cdot\vec{b}= 3$, find the projection of $\vec{b}$ on $\vec{a}$.

EXERCISE-3

1. Let $\vec{a}$ and $\vec{b}$ be two vectors and α be the angle between them, then $\vec{a}+\vec{b}$ is a unit vector, if

(a) $\alpha = \dfrac{\pi}{4}$ (b) $\alpha = \dfrac{\pi}{3}$ (c) $\alpha = \dfrac{2\pi}{3}$ (d) $\alpha = \dfrac{\pi}{2}$

2. The vector component of $\vec{b}$ prependicular to $\vec{a}$ is

(a) $(\vec{b}\cdot\vec{c})\vec{a}$ (b) $\frac{\vec{a}\times(\vec{b}\times\vec{a})}{|\vec{a}|^2}$ (c) $\vec{a}\times(\vec{b}\times\vec{a})$ (d) none of these

3. If $\vec{a},\vec{b},\vec{c}$ are any three mutually perpendicular vectors of equal magnitude a, then $|\vec{a}+\vec{b}+\vec{c}|$ isequal to

(a) a (b) $\sqrt{2}\,a$ (c) $\sqrt{3}\,a$ (d) none of these

4. The projection of the vector $\hat{i}+\hat{j}+\hat{k}$ along the vector of $\hat{j}$ is

(a) 1 (b) 0 (c) 2 (d) –1

(e) –2

5. If $\vec{a}$ and $\vec{b}$ are unit vectors, then the greatest value of $\sqrt{3}|\vec{a}+\vec{b}|+|\vec{a}-\vec{b}|$ is

(a) 2 (b) $2\sqrt{2}$ (c) 4 (d) none of these

6. The orthogonal projection of $\vec{a}$ on $\vec{b}$ is

(a) $\frac{(\vec{a}.\vec{b})\vec{a}}{|\vec{a}|^2}$ (b) $\frac{(\vec{a}.\vec{b})\vec{b}}{|\vec{b}|^2}$ (c) $\frac{\vec{a}}{|\vec{a}|^2}$ (d) $\frac{\vec{b}}{|\vec{a}|^2}$