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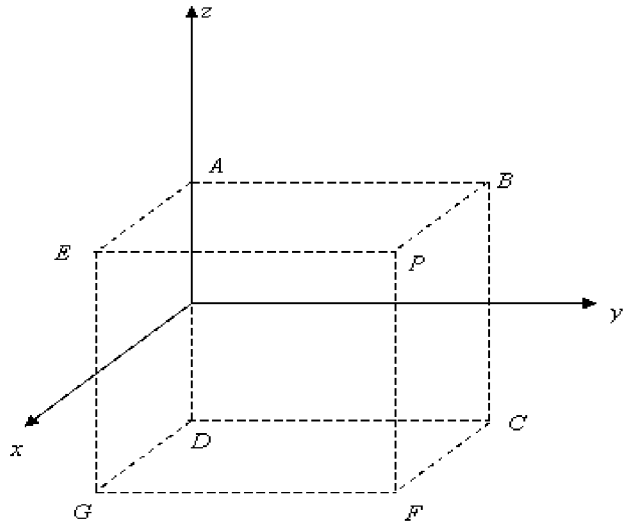
MATH@TD

Name: _____

MCV4U Chapter 6 - Introduction to Vectors: Practice Test

Multiple Choice
There may or may not be Multiple Choice Questions on the actual test.

1. $\overrightarrow{A}$ and $\overrightarrow{B}$ form a right angle. If $\left|\overrightarrow{A}\right|$ = 5 and $\left|\overrightarrow{B}\right|$ = 4, what is $\left|3\overrightarrow{A} + \overrightarrow{B}\right|$?
   a. 9.54
   b. 15.52
   c. 4.36
   d. 19.21
2. $\vec{a} + (\vec{b} + \vec{c}) = (\vec{a} + \vec{b}) + \vec{c}$ conveys which property of vectors?
   a. commutative property of addition
   b. associative property of addition
   c. distributive property of addition
   d. none of the above
3. $\overrightarrow{A}$ goes from (2, 1) to (4, –1). Determine the components of $\overrightarrow{A}$.
   a. (6, 0)
   b. (–2, 2)
   c. (2, –2)
   d. (0, 6)
4. A parallelogram is defined by $\overrightarrow{OA}$ = (1, 2) and $\overrightarrow{OB}$ = (3, 2). Determine the length of its diagonal.
   a. $\sqrt{5}$
   b. $2\sqrt{2}$
   c. $4\sqrt{2}$
   d. 32
5. Which of the following sets of vectors spans a plane in R^3?
   a. {(1, 0, 0), (2, 0, 0)}
   b. {(1, 3, 1), (2, 6, 2)}
   c. {(0, 2, 1), (0, 6, 3)}
   d. {(0, 2, 2), (2, 0, 2)}
6. Adding a vector to the zero vector
   a. produces the zero vector
   b. preserves the non-zero vector
   c. changes the vector's direction
   d. reduces the vector's magnitude



7. The prism is bisected by the *xy*-plane. The point $P = (3, 7, 3)$. Determine F.
   a. $(-3, 7, 3)$
   b. $(3, -7, 3)$
   c. $(3, 7, -3)$
   d. $(-3, -7, -3)$

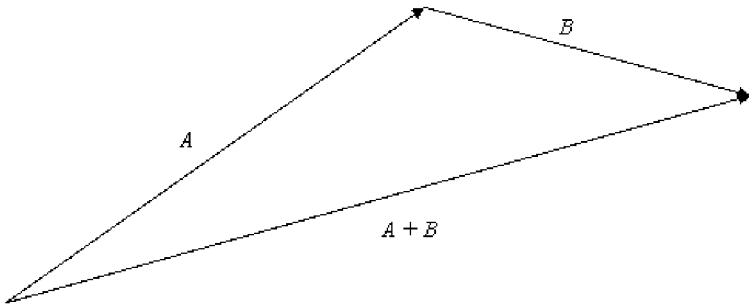
8. Write the vector $(2, -5)$ using unit vectors.
   a. $2\vec{i} + 5\vec{j}$
   b. $2\vec{i} - 5\vec{j}$
   c. $5\vec{i} + 2\vec{j}$
   d. $-5\vec{i} + 2\vec{j}$

9. If $\overrightarrow{A} = -3\vec{i} + 2\vec{j} + 4\vec{k}$, determine $\left|\overrightarrow{A}\right|$.
   a. $\sqrt{29}$
   b. $\sqrt{11}$
   c. $\sqrt{3}$
   d. 3

10. Which of the following would be a linear combination of $\{(a, b), (c, d)\}$? $(a, b, c, d \neq 0)$
    a. $(2a, b + 2d)$
    b. $(2a + c, 2b + d)$
    c. $(2a + 2c, b)$
    d. $(2a, 2d)$

Written Solutions:
There will definitely be problems like these on the test. A communications grade out of 10 will be awarded for well presented solutions.

11. $\left|\overrightarrow{A}\right| = 3$, $\left|\overrightarrow{B}\right| = 5$ and the angle between $\overrightarrow{A}$ and $\overrightarrow{B}$ is 30°. Determine $\left|\overrightarrow{A} + \overrightarrow{B}\right|$ and the angle $\overrightarrow{A}$ makes with $\overrightarrow{A} + \overrightarrow{B}$ **A/4**



12. If $\vec{a} = 2\vec{x} + \vec{y}$ and $\vec{b} = -7\vec{x} + 2\vec{y}$, express $\vec{x}$ and $\vec{y}$ in terms of $\vec{a}$ and $\vec{b}$. **T/3**

13. A triangle has sides represented by the vectors (1, 2) and (5, 6). Determine the vector representing the third side. **K/2**

14. If $\overrightarrow{A} = 2\vec{i} + \vec{j} - \vec{k}$ and $\overrightarrow{A} + \overrightarrow{B} = \vec{i} + 4\vec{j} + \vec{k}$, what is $\overrightarrow{B}$? (write the vector $\overrightarrow{B}$ in two ways.) **T/3**

15. Determine the magnitude of the vector going from (2, 1, 3) to (1, 1, 1). **K/3**

16. Does the set $\{(\frac{1}{2}, 1), (4, 8)\}$ span R^2? Whay or why not? **K/2**

17. What do the set of vectors $\{(1, 3, 2), (\frac{1}{2}, \frac{3}{2}, 1), (-2, -6, -4)\}$ span? Explain your reasoning. **A/3**

18. Vector $\overrightarrow{AB}$ goes from (1, 0) to (2, 1). Vector $\overrightarrow{CD}$ starts at (4, 2).
    a. Calculate the magnitude of $\overrightarrow{AB}$. **A/2**
    b. If $\overrightarrow{AB} = \overrightarrow{CD}$, determine the endpoint of $\overrightarrow{CD}$. **A/2**

19. If $3(a, 3, 2) - 2(3, b, b) = (-3, 1, -2)$, determine a and b. Describe the set spanned by the vectors. **A/4**

MCV4U Chapter 6 - Introduction to Vectors: Practice Test
Answer Section

MULTIPLE CHOICE

1. ANS: B PTS: 1 REF: Thinking
   OBJ: 6.3 - Multiplication of a Vector by a Scalar
2. ANS: B PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.4 - Properties of Vectors
3. ANS: C PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.6 - Operations with Algebraic Vectors in R^2
4. ANS: C PTS: 1 REF: Application
   OBJ: 6.6 - Operations with Algebraic Vectors in R^2
5. ANS: D PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.8 - Linear Combinations and Spanning Sets
6. ANS: B PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.2 - Vector Addition
7. ANS: C PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.5 - Vectors in R^2 and R^3
8. ANS: B PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.6 - Operations with Algebraic Vectors in R^2
9. ANS: A PTS: 1 REF: Knowledge and Understanding
   OBJ: 6.7 - Operations with Vectors in R^3
10. ANS: B PTS: 1 REF: Knowledge and Understanding
    OBJ: 6.8 - Linear Combinations and Spanning Sets

SHORT ANSWER

11. ANS:
    7.74

    PTS: 1 REF: Thinking OBJ: 6.2 - Vector Addition
12. ANS:
    $\vec{x} = \frac{1}{11}(2\vec{a} - \vec{b})$ and $\vec{y} = \frac{2}{11}(\vec{b} + \frac{7}{2}\vec{a})$

    PTS: 1 REF: Application OBJ: 6.4 - Properties of Vectors
13. ANS:
    (4, 4) or (–4, –4)

    PTS: 1 REF: Application OBJ: 6.6 - Operations with Algebraic Vectors in R^2
14. ANS:
    $-\vec{i} + 3\vec{j} + 2\vec{k}$

    PTS: 1 REF: Thinking OBJ: 6.7 - Operations with Vectors in R^3

15. ANS:
$\sqrt{5}$

PTS: 1 REF: Application OBJ: 6.7 - Operations with Vectors in R^3

16. ANS:
No, because the two vectors are collinear.

PTS: 1 REF: Communication
OBJ: 6.8 - Linear Combinations and Spanning Sets

17. ANS:
They are all collinear, so they only span a line in R^3.

PTS: 1 REF: Thinking OBJ: 6.8 - Linear Combinations and Spanning Sets

PROBLEM

18. ANS:
a. Use the distance formula:
$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(2-1)^2 + (1-0)^2} = \sqrt{2}$$
b. Determine the slope of $\overrightarrow{AB}$ to determine its direction:
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{1}{1}$$
Use the slope to determine the possible endpoint, (5, 3). Check by determining the magnitude of $\overrightarrow{CD}$ with endpoint (5, 3):
$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(5-4)^2 + (3-2)^2} = \sqrt{2}$$

PTS: 1 REF: Thinking OBJ: 6.1 - An Introduction to Vectors

19. ANS:
Looking at the *x*-components:
$3a - 6 = -3$
So, $a = 1$.
Looking at the *y*-components:
$9 - 2b = 1$
So, $b = 4$.
Check: $(3 - 6, 9 - 8, 6 - 8) = (-3, 1, -2)$
This set spans a plane in R^3 since the vectors (1, 3, 2) and (3, 4, 4) are not collinear. The vector (–3, 1, –2) is not needed to span this plane since it can be written as a linear combination of the other two vectors.

PTS: 1 REF: Communication
OBJ: 6.8 - Linear Combinations and Spanning Sets