A∞Ω
Math@TD

Name: _____

MCV4U - Chapter 7: Review Practice

Multiple Choice
The actual Test will be MUCH shorter :)
Note that the amswers are attached at the back. If you have questions about any of the problems, please let me know!

1. A force vector has a magnitude of 14 N and makes an angle of 20° with the *x*-axis. What is the magnitude of its horizontal component?
   a. 13.16 N
   b. 4.79 N
   c. 14.00 N
   d. 14.90 N

2. Susan pulls on a rope a sleigh with a force of 120 N. If the rope makes an angle of 25° with the horizontal, what is the force that tends to lift the sleigh?
   a. 120.00 N
   b. 108.76 N
   c. 50.71 N
   d. 84.85 N

3. Two forces act on an object. The forces have magnitudes of 3 N and 4 N, and act at an angle of 35° to each other. What is the angle that the resultant makes with the 3 N force?
   a. 20.08°
   b. 14.91°
   c. 35.00°
   d. More information is required.

4. A 20 N force acts on an object. The horizontal component of this force has a magnitude of 12 N. What is the angle the force makes with the horizontal?
   a. 53.13°
   b. 36.87°
   c. 23.58°
   d. 66.42°

5. An airplane is heading north with an airspeed of 400 km/h. The plane encounters a wind from the east at 100 km/h. What is the magnitude of the resultant ground velocity?
   a. 387 km/h
   b. 400 km/h
   c. 412 km/h
   d. 500 km/h

6. If $\vec{a} \cdot \vec{b} = 8$, then what is $\vec{b} \cdot \vec{a}$ equal to?
   a. 8
   b. −8
   c. $\frac{1}{8}$
   d. More information is required.

7. If $\vec{a} \cdot \vec{b} = 9$ and $\left|\vec{a}\right| = 3$, what is $\left|\vec{b}\right|$ equal to?
   a. 9
   b. 81
   c. 3
   d. More information is required.

8. Under which condition is $\vec{x} \cdot \vec{y} = 0$?

    a. $\vec{x}$ and $\vec{y}$ are in the same direction.

    b. $\vec{x}$ and $\vec{y}$ are perpendicular.

    c. $\vec{x}$ and $\vec{y}$ are in opposite directions.

    d. None of these conditions force $\vec{x} \cdot \vec{y}$ to be zero.

9. Two forces of 3N and 8N act on an object at an angle of 30° to each other. What is the dot product of these force vectors?

    a. 4.24   c. 12.00

    b. 20.78   d. 24.00

10. Two forces of 4N and 5N act on an object and their corresponding force vectors have a dot product of 8. What is the angle between the two vectors?

    a. 66.42°   c. 23.58°

    b. 27.27°   d. 62.73°

11. Suppose that $\vec{a} \cdot \left(\vec{b} - 3\vec{c} \right) = 0$ and $\vec{a} \cdot \vec{c} = 2$. What is $\vec{a} \cdot \vec{b}$ equal to?

    a. 6   c. −6

    b. 2   d. −2

12. Which of the following pairs of vectors are perpendicular to each other?

    a. (1, 3, 2) and (−2, −6, −4)   c. (4, 14, −18) and (6, 21, −27)

    b. (13, 4, 2) and (2, −5, −3)   d. (5, −4, 3) and (−3, 4, −5)

13. For what value of s is the line segment connecting the origin with (3, s) and the line segment connecting the origin with (18, 6) perpendicular?

    a. 0   c. −1

    b. 1   d. −9

14. To the nearest degree, what is the angle between the vectors (1, 2, 0) and (−3, 2, 1)?

    a. 0°   c. 83°

    b. 42°   d. 107°

15. Given that the vectors $\vec{a} = (6, -2, 2s)$ and $\vec{b} = (-1, s + 1, 2)$ are perpendicular, what is the value of s?

    a. −4   c. 0

    b. −1   d. 4

16. Given that $\vec{x} = (1, s, 2s +1)$ and $\vec{y} = (2, 2, 3)$, for which value of s will $\vec{x} \cdot \vec{y} = 5$?

    a. −5   c. 1

    b. 0   d. 5

17. To the nearest degree, what is the angle between $\vec{x} = (1, -3, 4)$ and $\vec{y} = (-2, -2, 3)$?

    a. 40°   c. 63°

    b. 48°   d. 80°

18. What is the dot product of the vectors $(4, -10, 3)$ and $(1, 1, 5)$?
    a. -113 c. 4
    b. 0 d. 9

19. What is the angle, to the nearest degree, that the vector $(3, 4, -2)$ makes with the positive y-axis?
    a. $33°$ c. $48°$
    b. $42°$ d. $56°$

20. What is the direction cosine for the vector $(7, 4, -3)$ with the positive z-axis?
    a. $-\dfrac{3}{74}$ c. $\dfrac{3}{74}$
    b. $-\dfrac{3}{\sqrt{74}}$ d. $\dfrac{3}{\sqrt{74}}$

21. For the vectors $\overrightarrow{a} = (1, 0, -4)$ and $\overrightarrow{b} = (5, 2, 1)$, what is the scalar projection of $\overrightarrow{b}$ on $\overrightarrow{a}$?
    a. $\dfrac{1}{17}$ c. $\dfrac{1}{30}$
    b. $\dfrac{1}{\sqrt{17}}$ d. $\dfrac{1}{\sqrt{30}}$

22. If ABC is a triangle with vertices $A(0, 1)$, $B(2, 0)$, and $C(3, 3)$, then what is the vector projection of $\overrightarrow{AB}$ on $\overrightarrow{AC}$?
    a. $\dfrac{4}{13}(3, 2)$ c. $\dfrac{4}{13}(2, -1)$
    b. $\dfrac{4}{5}(3, 2)$ d. $\dfrac{4}{5}(2, -1)$

23. What is the vector projection of vector $\overrightarrow{x} = (2, 1, 4)$ on $\overrightarrow{y} = (-3, 4, 0)$?
    a. $-\dfrac{2}{21}(2, 1, 4)$ c. $-\dfrac{2}{25}(-3, 4, 0)$
    b. $-\dfrac{2}{\sqrt{21}}(2, 1, 4)$ d. $-\dfrac{2}{5}(-3, 4, 0)$

24. What is the scalar projection of $\overrightarrow{i} + \overrightarrow{j}$ on $\overrightarrow{j} + 2\overrightarrow{k}$?
    a. $\dfrac{1}{\sqrt{5}}$ c. $\dfrac{1}{\sqrt{2}}$
    b. $\dfrac{1}{5}$ d. $\dfrac{1}{2}$

25. For which t value will the vector $(1, t, t + 1)$ be perpendicular to the vectors $(-6, 2, 2t)$ and $(-15, t, t)$?
    a. $\dfrac{5}{2}$ c. -3
    b. 1 d. There is no such t-value.

26. The vectors $\vec{a}$ and $\vec{b}$ have the same magnitude. The angle between the vectors is 125°, and the magnitude of their cross product is 20. What is $\left|\vec{a}\right|$?

   a.   4.08   c.   16.4
   b.   4.94   d.   24.4

27. Suppose $\vec{a} = (4, -6, 10)$ and $\vec{b} = (-6, 9, -15)$. What is $\vec{a} \times \vec{b}$?

   a. $(-24, -54, -150)$ c. $(1, -1, -1)$
   b. $(0, 0, 0)$ d. $(-3, -2, 0)$

28. What is the magnitude of the cross product between $(3, 0, -4)$ and $(2, 0, 1)$?

   a.   2   c. $\sqrt{2}$
   b.   5   d.   11

29. If ABC is a triangle with vertices $A(2, 1, 4)$, $B(2, 0, 1)$, and $C(3, 0, 2)$, then what is $\overrightarrow{AB} \times \overrightarrow{BC}$?

   a. $(2, 8, -3)$ c. $(1, 3, -1)$
   b. $(-2, -8, 3)$ d. $(-1, -3, 1)$

30. Suppose $\vec{a}$, $\vec{b}$, and $\vec{c}$ are vectors such that $\vec{a} \times \vec{b} = (3, 1, -5)$ and $\vec{c} \times \vec{a} = (7, -7, 1)$. What is $\left(\vec{b} - \vec{c}\right) \times \left(-\vec{a}\right)$?

   a. $(-4, 8, -6)$ c. $(10, -6, -4)$
   b. $(4, -8, 6)$ d. $(-10, 6, 4)$

31. How much work, to the nearest kJ, is done in pulling a sleigh across a distance of 330 m by a force of 88 N applied at an angle of 38° to the ground?

   a.   18 kJ   c.   29 kJ
   b.   23 kJ   d.   37 kJ

32. What is the area of the parallelogram formed by the vectors $\vec{a} = (1, 0, 2)$ and $\vec{b} = (0, -1, 2)$?

   a.   3   c. $\dfrac{3}{2}$

   b.   9   d. $\dfrac{9}{2}$

33. The points $A(1, 2, 3)$, $B(2, 2, 3)$, and $C(3, 5, 7)$ form a triangle. What is the area of ABC?

   a.   5   c. $\dfrac{5}{2}$

   b.   25   d. $\dfrac{25}{2}$

34. A 50 N force is applied at the end of a wrench that is 20 cm long. The force makes an angle of 50° with the wrench. What is the magnitude of the torque about the point of rotation?

   a.   6.4 J   c.   640 J
   b.   7.7 J   d.   770 J

Written Solutions: On the (MUCH SHORTER) test, provide clear solutions to the following problems. You will receive a ***Communications grade, out of 10*** for how well your math is presented on the test.

35. Two forces of 10 N and 30 N act at an angle of 40° to each other. Determine the resultant of these forces.

36. A force vector has a magnitude of 30 N and makes an angle of 40° with the *y*-axis. What is the magnitude of the vertical component?

37. Three forces act on an object as shown in the diagram. Determine the equilibrant of these three vectors.
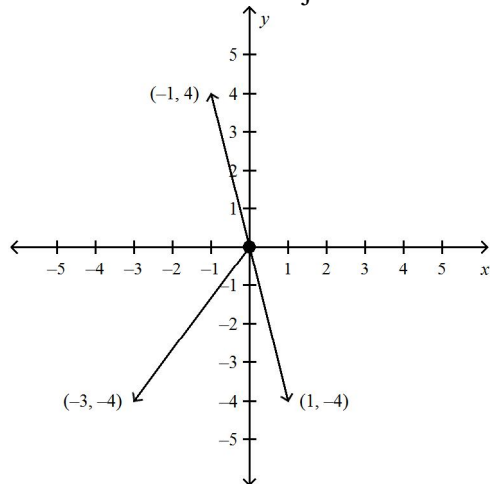
38. Explain why three forces of magnitudes 4 N, 5 N, and 10 N can not produce equilibrium.

39. An airplane is heading due west at 400 km/h when it encounters a wind from the northeast at 120 km/h. How far will the airplane travel in two hours?

40. Determine the angle between $\overrightarrow{x}$ and $\overrightarrow{y}$, given that $\overrightarrow{x}$ and $\overrightarrow{y}$ are unit vectors and $\overrightarrow{x} \cdot \overrightarrow{y} = \dfrac{\sqrt{3}}{2}$.

41. Suppose $\overrightarrow{a} \cdot \overrightarrow{b} = 2$ and $\overrightarrow{a} \cdot \overrightarrow{c} = 5$. Determine the value of $\overrightarrow{a} \cdot \left(2\overrightarrow{b} - 3\overrightarrow{c} \right)$.

42. Determine $\left(6\overrightarrow{i} + 2\overrightarrow{j} \right) \cdot \left(\overrightarrow{i} - 4\overrightarrow{j} + \overrightarrow{k} \right)$.

43. Determine the value of *t* such that the vectors (*t*, 3*t*, 3) and (*t*, 2, 3) are perpendicular.

44. Determine the angle, to the nearest degree, between the vectors $\overrightarrow{x} = (4, 6, -2)$ and $\overrightarrow{y} = (1, 8, 2)$.

45. The triangle *ABC* has vertices at *A*(−1, 3), *B*(0, 0), and *C*(−2, 8). Determine the measure of ∠*ABC*.

46. Determine the direction angles, to the nearest degree, for the vector $\overrightarrow{a} = (6, -2, -3)$.

47. Determine the vector projection of the vector (0, 8) on the vector (−1, −1).

48. The angle between the vectors $\vec{x}$ and $\vec{y}$ is 120° and the scalar projection of $\vec{x}$ on $\vec{y}$ is −5. $\vec{x}$ = (6, k, 8) for some number k. Determine the value of k.

49. Determine the vector projection of $\overrightarrow{RS}$ on $\overrightarrow{RT}$.
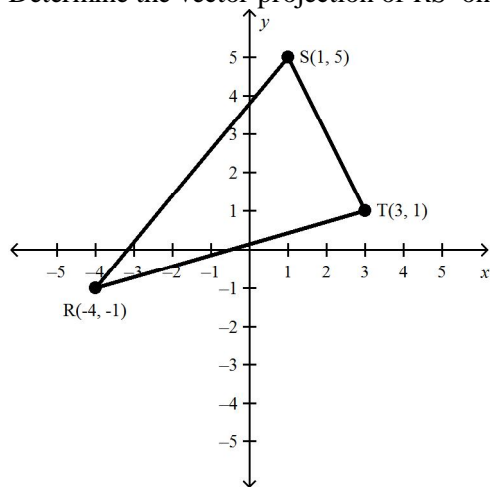
50. Determine the numbers a, b, and c such that the vector (a, b, c) is an unit vector with direction angles of 60.3°, 34.0°, and 105°.

51. If ABC is a triangle with vertices A(2, 2, 5), B(3, 0, 2), and C(4, 0, 4), then what is the scalar projection of $\overrightarrow{AB}$ on $\overrightarrow{AC}$?

52. Suppose $\left(2,-3,4\right) \times (1,7,a) = (-16,12,17)$. Determine the value of a.

53. ABC is a triangle with vertices A(−2, 2, 3), B(2, 2, 5), and C(0, 0, 9). Determine $\overrightarrow{AB} \times \overrightarrow{AC}$.

54. Suppose $\vec{a}$, $\vec{b}$, and $\vec{c}$ are vectors such that $\vec{a} \times \vec{b}$ = (2, −1, 7) and $\vec{a} \times \vec{c}$ = (10, 8, −3). Determine $\left(3\vec{b} - \vec{c}\right) \times \left(2\vec{a}\right)$.

55. Suppose $\left(2,-3,a-1\right) \times (2,1,2a) = (8,0,8)$. Determine the value of a.

56. Calculate the amount of work done when a sleigh is pulled 50 m by a force of 30 N applied at an angle of 30° with the ground.

57. A 50 N force is applied at the end of a 30 cm wrench. If the force makes an angle of 67° with the wrench, what is the magnitude of the torque about the point of rotation?

58. A nut is being tightened by a 28 cm wrench into some plywood. The torque about the point the rotation has a magnitude of 9.7 J and the magnitude of the force being applied is 45 N. The force makes an acute angle with the wrench. Determine this angle to the nearest degree.

59. Determine the amount of work done in sliding a chest 4 m across the floor against a frictional force of 64 N.

60. The points $R(0, 2, 4)$, $S(1, 3, 2)$, and $T(-1, 2, 6)$ form a triangle. What is the area of ABC?

MCV4U - Chapter 7: Review Practice
Answer Section

MULTIPLE CHOICE

  1. ANS: A   PTS: 1
  2. ANS: C   PTS: 1
  3. ANS: A   PTS: 1
  4. ANS: A   PTS: 1
  5. ANS: C   PTS: 1
  6. ANS: A   PTS: 1
  7. ANS: D   PTS: 1
  8. ANS: B   PTS: 1
  9. ANS: B   PTS: 1
10. ANS: A   PTS: 1
11. ANS: A   PTS: 1
12. ANS: B   PTS: 1
13. ANS: D   PTS: 1
14. ANS: C   PTS: 1
15. ANS: D   PTS: 1
16. ANS: B   PTS: 1
17. ANS: A   PTS: 1
18. ANS: D   PTS: 1
19. ANS: B   PTS: 1
20. ANS: B   PTS: 1
21. ANS: B   PTS: 1
22. ANS: A   PTS: 1
23. ANS: C   PTS: 1
24. ANS: A   PTS: 1
25. ANS: C   PTS: 1
26. ANS: B   PTS: 1
27. ANS: B   PTS: 1
28. ANS: D   PTS: 1
29. ANS: D   PTS: 1
30. ANS: C   PTS: 1
31. ANS: B   PTS: 1
32. ANS: A   PTS: 1
33. ANS: C   PTS: 1
34. ANS: B   PTS: 1

SHORT ANSWER

35. ANS:
The resultant has a magnitude of 38.21 N. It makes an angle of 30.31° with the 10 N force and of 9.69° with the 30 N force.

PTS: 1

36. ANS:
22.98 N

PTS: 1

37. ANS:
The equilibrant is the vector from the origin to (3, 4). Equivalently the resultant is a force of magnitude 5 N and makes an angle of 53.1° with the *x*-axis and of 36.9° with the *y*-axis.

PTS: 1

38. ANS:
triangle inequality: $4 + 5 = 9 < 10$

PTS: 1

39. ANS:
984 km

PTS: 1

40. ANS:
30°

PTS: 1

41. ANS:
−11

PTS: 1

42. ANS:
−2

PTS: 1

43. ANS:
$t = -3$

PTS: 1

44. ANS:
39°

PTS: 1

45. ANS:
4.4°

PTS: 1
46. ANS:
31°, 107°, 115°

PTS: 1
47. ANS:
−4(−1, −1) or simply (4, 4)

PTS: 1
48. ANS:
$k = 0$

PTS: 1
49. ANS:
$\frac{47}{53}$ (7,2) or simply $\left(\frac{329}{53}, \frac{94}{53} \right) \doteq \left(6.21, 1.77 \right)$

PTS: 1
50. ANS:
(0.50, 0.83, −0.26)

PTS: 1
51. ANS:
3

PTS: 1
52. ANS:
$a = -4$

PTS: 1
53. ANS:
(4, −20, −8)

PTS: 1
54. ANS:
(8, 22, −48)

PTS: 1
55. ANS:
$a = -1$

PTS: 1

56. ANS:
1299 J

PTS: 1

57. ANS:
13.8 J

PTS: 1

58. ANS:
50°

PTS: 1

59. ANS:
256 J

PTS: 1

60. ANS:
$\dfrac{\sqrt{5}}{2} \doteq 1.12$

PTS: 1