Exam Math 2013 Practice Test 1

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find an equation for the sphere with the given center and radius.

1) Center (–4, 7, 0), radius = 8 1) _____

A) $x^2 + y^2 + z^2 + 8x - 14y = -1$ B) $x^2 + y^2 + z^2 + 8x + 14y = -1$

C) $x^2 + y^2 + z^2 - 8x - 14y = -1$ D) $x^2 + y^2 + z^2 - 8x + 14y = -1$

Solve the problem.

2) An airplane is flying in the direction 56° west of north at 882 km/hr. Find the component form of the velocity of the airplane, assuming that the positive x–axis represents due east and the positive y–axis represents due north. 2) _____

A) $\langle -493.2, 731.2 \rangle$ B) $\langle -0.8290, 0.5592 \rangle$

C) $\langle 460.0, 752.5 \rangle$ D) $\langle -731.2, 493.2 \rangle$

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

3) $6 \le y \le 7, 6 \le z \le 7$ 3) _____

A) The cube located in the first quadrant and with sides 6 units in length

B) The square with corners at (0, 6, 6), (0, 6, 7), (0, 7, 6), and (0, 7, 7)

C) The line between the points (0, 6, 6) and (0, 7, 7)

D) The infinitely long square prism parallel to the x–axis

Write one or more inequalities that describe the set of points.

4) The exterior of the sphere of radius 1 centered at the point (2, –5, –3) 4) _____

A) $(x + 2)^2 + (x - 5)^2 + (x - 3)^2 < 1$ B) $(x - 2)^2 + (x + 5)^2 + (x + 3)^2 < 1$

C) $(x + 2)^2 + (x - 5)^2 + (x - 3)^2 \ge 1$ D) $(x - 2)^2 + (x + 5)^2 + (x + 3)^2 > 1$

Find the angle between u and v in radians.

5) $\mathbf{u} = 2\mathbf{j} - 4\mathbf{k}$, $\mathbf{v} = 9\mathbf{i} - 4\mathbf{j} - 8\mathbf{k}$ 5) _____

A) 0.44 B) 1.56 C) 1.13 D) 1.44

Give a geometric description of the set of points whose coordinates satisfy the given conditions.

6) $(x - 4)^2 + (y - 5)^2 + (z - 5)^2 < 1, -5 \le z \le 0$ 6) _____

A) All points outside the lower hemisphere centered at (4, 5, 5)

B) All points within the lower hemisphere centered at (4, 5, 5)

C) No set of points satisfy the given relations.

D) All points on the lower hemisphere centered at (4, 5, 5)

Solve the problem.

7) For the vectors $\mathbf{u}$ and $\mathbf{v}$ with magnitudes $|\mathbf{u}| = 3$ and $|\mathbf{v}| = 6$, find the angle θ between $\mathbf{u}$ and $\mathbf{v}$ which makes $|\text{proj}_{\mathbf{u}}\, \mathbf{v}| = 1$ 7) _____

A) 19.47 B) 70.53 C) 60.00 D) 80.41

8) Find a formula for the distance from the point P(x, y, z) to the xy plane. 8) _____

A) $\sqrt{x^2 + y^2}$ B) y C) z D) x

Find the indicated vector.

9) Let $\mathbf{u} = \langle -4, -8 \rangle$, $\mathbf{v} = \langle 2, 5 \rangle$. Find $\frac{4}{5}\mathbf{u} + \frac{3}{5}\mathbf{v}$. 9) _____

A) $\left\langle -2, -\frac{17}{5} \right\rangle$ B) $\left\langle -8, \frac{23}{5} \right\rangle$ C) $\left\langle -\frac{8}{5}, -\frac{9}{5} \right\rangle$ D) $\left\langle -\frac{17}{5}, -2 \right\rangle$

Solve the problem.

10) Find a formula for the distance from the point P(x, y, z) to the x–axis. 10) _____

A) $\sqrt{y^2 + z^2}$ B) $\sqrt{x + z}$ C) $\sqrt{y + z}$ D) $\sqrt{x^2 + z^2}$

Find the component form of the specified vector.

11) The vector $\overrightarrow{PQ}$, where P = (6, –9) and Q = (–1, –7) 11) _____

A) $\langle 5, -16 \rangle$ B) $\langle -3, -7 \rangle$ C) $\langle 7, -2 \rangle$ D) $\langle -7, 2 \rangle$

Express the vector as a product of its length and direction.

12) $4\mathbf{i} + 8\mathbf{j} + 8\mathbf{k}$ 12) _____

A) $12\left(\frac{1}{3}\mathbf{i} + \frac{2}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}\right)$ B) $12(\mathbf{i} + \mathbf{j} + \mathbf{k})$

C) $12(4\mathbf{i} + 8\mathbf{j} + 8\mathbf{k})$ D) $12\left(\frac{1}{36}\mathbf{i} + \frac{1}{18}\mathbf{j} + \frac{1}{18}\mathbf{k}\right)$

Solve the problem.

13) For the triangle with vertices located at A(3, 5, 3), B(2, 4, 5), and C(1, 1, 1) , find a vector from vertex C to the midpoint of side AB. 13) _____

A) $\frac{5}{2}\mathbf{i} + \frac{9}{2}\mathbf{j} + 4\mathbf{k}$ B) $\frac{7}{2}\mathbf{i} + \frac{11}{2}\mathbf{j} + 5\mathbf{k}$ C) $\frac{3}{2}\mathbf{i} + \frac{7}{2}\mathbf{j} + 3\mathbf{k}$ D) $\frac{1}{2}\mathbf{i} + \frac{3}{2}\mathbf{j} + \frac{1}{2}\mathbf{k}$

Calculate the direction of $\overrightarrow{P_1P_2}$ and the midpoint of line segment P_1P_2.

14) $P_1(6, -6, -4)$ and $P_2(8, -5, -2)$ 14) _____

A) $\frac{2}{3}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}; \left(1, \frac{1}{2}, 1\right)$ B) $\frac{2}{3}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}; \left(4, -\frac{5}{2}, -1\right)$

C) $\frac{2}{3}\mathbf{i} + \frac{1}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}; \left(7, -\frac{11}{2}, -3\right)$ D) $2\mathbf{i} + 2\mathbf{j} + \frac{4}{3}\mathbf{k}; (3, -3, -2)$

Find $\mathbf{v} \cdot \mathbf{u}$.

15) $\mathbf{v} = 9\mathbf{i} - 2\mathbf{j}$ and $\mathbf{u} = -2\mathbf{i} + 7\mathbf{j}$ 15) _____

A) –32 B) $7\mathbf{i} + 5\mathbf{j}$ C) $-18\mathbf{i} - 14\mathbf{j}$ D) –4

Find the vector $\text{proj}_{\mathbf{v}}\,\mathbf{u}$.

16) $\mathbf{v} = 3\mathbf{i} - \mathbf{j} + 3\mathbf{k}$, $\mathbf{u} = 11\mathbf{i} + 2\mathbf{j} + 10\mathbf{k}$ 16) _____

A) $\frac{195}{19}\mathbf{i} - \frac{65}{19}\mathbf{j} + \frac{195}{19}\mathbf{k}$ B) $\frac{671}{15}\mathbf{i} + \frac{122}{15}\mathbf{j} + \frac{122}{3}\mathbf{k}$

C) $\frac{671}{225}\mathbf{i} + \frac{122}{225}\mathbf{j} + \frac{122}{45}\mathbf{k}$ D) $\frac{183}{19}\mathbf{i} - \frac{61}{19}\mathbf{j} + \frac{183}{19}\mathbf{k}$

Find the angle between u and v in radians.

17) $\mathbf{u} = -2\mathbf{i} - 9\mathbf{j}$, $\mathbf{v} = 2\mathbf{i} + 3\mathbf{j} + 6\mathbf{k}$ 17) _____

A) 1.80 B) 2.07 C) −0.50 D) 1.58

18) $\mathbf{u} = 4\mathbf{j} - 6\mathbf{k}$, $\mathbf{v} = 6\mathbf{i} - 9\mathbf{j} - 4\mathbf{k}$ 18) _____

A) 1.72 B) 1.64 C) 1.57 D) −0.14

Find an equation for the line that passes through the given point and satisfies the given conditions.

19) P = (−8, 4); perpendicular to $\mathbf{v} = -5\mathbf{i} - 3\mathbf{j}$ 19) _____

A) $y - 4 = -\frac{7}{3}(x + 5)$ B) $-3x + 5y = 44$

C) $-5x - 3y = 28$ D) $-5x - 3y = 34$

Solve the problem.

20) How much work does it take to slide a box 37 meters along the ground by pulling it with a 242 N force at an angle of 45° from the horizontal? 20) _____

A) $8954\sqrt{2}$ joules B) $\frac{8954}{\sqrt{2}}$ joules C) 8954 joules D) $4477\sqrt{2}$ joules

Find the length and direction (when defined) of $\mathbf{u} \times \mathbf{v}$.

21) $\mathbf{u} = 4\mathbf{i} + 2\mathbf{j} + 8\mathbf{k}$, $\mathbf{v} = -\mathbf{i} - 2\mathbf{j} - 2\mathbf{k}$ 21) _____

A) $6\sqrt{5}; \frac{2\sqrt{5}}{5}\mathbf{i} + \frac{\sqrt{5}}{5}\mathbf{k}$ B) $6\sqrt{5}; \frac{2\sqrt{5}}{5}\mathbf{i} - \frac{\sqrt{5}}{5}\mathbf{k}$

C) $180; \frac{1}{15}\mathbf{i} + \frac{1}{30}\mathbf{k}$ D) $180; \frac{2\sqrt{5}}{15}\mathbf{i} + \frac{\sqrt{15}}{15}\mathbf{j} + \frac{\sqrt{5}}{15}\mathbf{k}$

22) $\mathbf{u} = -\frac{1}{2}\mathbf{i} + \frac{3}{2}\mathbf{j} + \mathbf{k}$, $\mathbf{v} = \mathbf{i} + \mathbf{j} + 2\mathbf{k}$ 22) _____

A) $2\sqrt{2}; -\frac{\sqrt{2}}{2}\mathbf{i} + \frac{\sqrt{2}}{2}\mathbf{j} - \frac{\sqrt{2}}{2}\mathbf{k}$ B) $8; \frac{1}{4}\mathbf{i} - \frac{1}{4}\mathbf{j} + \frac{1}{2}\mathbf{k}$

C) $8; \frac{1}{2}\mathbf{i} - \frac{1}{4}\mathbf{j} - \frac{1}{4}\mathbf{k}$ D) $2\sqrt{3}; \frac{\sqrt{3}}{3}\mathbf{i} + \frac{\sqrt{3}}{3}\mathbf{j} - \frac{\sqrt{3}}{3}\mathbf{k}$

Solve the problem.

23) Find the area of the triangle determined by the points P(−3, 6, −4), Q(2, −9, −7), and R(5, −8, −7). 23) _____

A) $\frac{\sqrt{2590}}{2}$ B) $\sqrt{2590}$ C) $\frac{\sqrt{45{,}190}}{2}$ D) $\sqrt{45{,}190}$

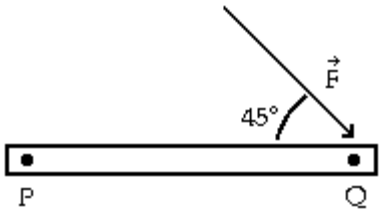
Find the triple scalar product $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$ of the given vectors.

24) $\mathbf{u} = 4\mathbf{i} + 2\mathbf{j} - \mathbf{j}$; $\mathbf{v} = 7\mathbf{i} + 6\mathbf{j} - 6\mathbf{k}$; $\mathbf{w} = 8\mathbf{i} + 5\mathbf{j} - 9\mathbf{k}$ 24) _____

A) −197 B) −113 C) −53 D) −22

Solve the problem.

25) Find the magnitude of the torque in foot–pounds at point P for the following lever: 25) _____



$\left|\overrightarrow{PQ}\right| = 8$ in. and $|\mathbf{F}| = 10$ lb

A) 877.56 ft–lb B) –3900.25 ft–lb C) 3900.25 ft–lb D) 80 ft–lb

Find parametric equations for the line described below.

26) The line through the point P(5, 1, 5) parallel to the vector $-6\mathbf{i} + 4\mathbf{j} - 4\mathbf{k}$ 26) _____

A) $x = 6t - 5$, $y = 4t - 1$, $z = -4t - 5$ B) $x = -6t - 5$, $y = 4t - 1$, $z = -4t - 5$

C) $x = -6t + 5$, $y = 4t + 1$, $z = -4t + 5$ D) $x = 6t + 5$, $y = 4t + 1$, $z = -4t + 5$

27) The line through the points P(–1, –1, –3) and Q(5, –6, 5) 27) _____

A) $x = t - 6$, $y = t + 5$, $z = -3t - 8$

B) $x = 6t - 1$, $y = -5t - 1$, $z = 8t - 3$

C) $x = 6t + 1$, $y = -5t + 1$, $z = 8t + 3$

Find a parametrization for the line segment beginning at P_1 and ending at P_2.

28) $P_1(7, 3, 1)$ and $P_2(0, 3, -4)$ 28) _____

A) $x = 7t$, $y = 3t$, $z = 5t - 4$ B) $x = -7t + 7$, $y = 3t$, $z = -5t + 1$

C) $x = -7t + 7$, $y = 3$, $z = -5t + 1$ D) $x = 7t$, $y = 3$, $z = 5t - 4$

Write the equation for the plane.

29) The plane through the point P(3, –3, 7) and normal to $\mathbf{n} = -6\mathbf{i} - 8\mathbf{j} + 2\mathbf{k}$. 29) _____

A) $6x + 8y - 2z = -56$ B) $-3x + 3y + 7z = -56$

C) $-6x - 8y + 2z = 20$ D) $3x - 3y - 7z = -56$

30) The plane through the point P(5, –7, –7) and parallel to the plane $-8\mathbf{x} - 5y + 8\mathbf{z} = -67$. 30) _____

A) $4y = -61$ B) $-8x - 5y + 8z = -51$

C) $-8x - 5y + 8z = -61$ D) $-8x - 5y + 8z = 61$

31) The plane through the point A(–4, –3, 9) perpendicular to the vector from the origin to A. 31) _____

A) $4x - 3y - 9z = -2$ B) $4x + 3y - 9z = \sqrt{106}$

C) $4x + 3y - 9z = -106$ D) $-4x - 3y + 9z = -106$

Calculate the requested distance.

32) The distance from the point S(–3, 3, –7) to the line $x = 5 + 2t$, $y = 9 + 6t$, $z = -10 + 9t$ 32) _____

A) $\frac{12564}{121}$ B) $\frac{6\sqrt{349}}{11}$ C) $\frac{6\sqrt{349}}{121}$ D) $\frac{12564}{11}$

33) The distance from the point S(–9, 1, –4) to the plane $2x + 2y + z = 1$ 33) _____

A) $\frac{7}{3}$ B) $\frac{11}{9}$ C) 7 D) $\frac{11}{3}$

34) The distance from the point S(5, –1, 1) to the plane $-9x + 6y + 2z = -8$ 34) _____

A) $\frac{41}{121}$ B) $\frac{41}{11}$ C) $\frac{61}{11}$ D) $\frac{61}{121}$

Find the angle between the planes.

35) $9x + 8y + 5z = 7$ and $8x + 7y + 2z = -8$ 35) _____

A) 1.363 B) 1.528 C) 1.414 D) 0.208

36) $7x - 6y - 9z = -2$and$- 2x + 9y - 10z = -5$ 36) _____

A) 0.126 B) 1.526 C) 1.282 D) 1.445

Find the intersection.

37) $x = -6 + 9t$, $y = -9 + 3t$, $z = 2 + 2t$; $4x + 9y + 8z = -10$ 37) _____

A) (–15, –12, 0) B) $\left(3, -\frac{44}{79}, 3\right)$

C) $\left(-15, -\frac{518}{79}, -1\right)$ D) (3, –6, 4)

38) $-5x - 7y - 4z = -2$, $6x + 2y + 8z = 5$ 38) _____

A) $x = -48t + \frac{31}{32}$, $y = 16t - \frac{13}{32}$, $z = 32t$ B) $x = -1536t - 31$, $y = 512t + 13$, $z = -32t$

C) $x = -48t - 31$, $y = 16t - 13$, $z = -32t$ D) $x = 48t + 31$, $y = -16t + -13$, $z = -32t$

If r(t) is the position vector of a particle in the plane at time t, find the indicated vector.

39) $\mathbf{r}(t) = (5t^2 + 3)\mathbf{i} + \left(\frac{1}{12}t^3\right)\mathbf{j}$. 39) _____

Find the velocity vector of the particle.

A) $\mathbf{v}(t) = (10t)\mathbf{i} - \left(\frac{1}{4}t^3\right)\mathbf{j}$ B) $\mathbf{v}(t) = (10t)\mathbf{i} + \left(\frac{1}{4}t^3\right)\mathbf{j}$

C) $\mathbf{v}(t) = \left(\frac{1}{4}t^2\right)\mathbf{i} + (10t)\mathbf{j}$ D) $\mathbf{v}(t) = (10)\mathbf{i} + \left(\frac{1}{2}t\right)\mathbf{j}$

40) $\mathbf{r}(t) = (\cos 2t)\mathbf{i} + (5 \sin t)\mathbf{j}$ 40) _____

Find the acceleration vector.

A) $\mathbf{a}(t) = (-4 \cos 2t)\mathbf{i} + (-25 \sin t)\mathbf{j}$ B) $\mathbf{a}(t) = (-2 \cos 2t)\mathbf{i} + (5 \sin t)\mathbf{j}$

C) $\mathbf{a}(t) = (-4 \cos 2t)\mathbf{i} + (-5 \sin t)\mathbf{j}$ D) $\mathbf{a}(t) = (4 \cos 2t)\mathbf{i} + (-5 \sin t)\mathbf{j}$

The position vector of a particle is r(t). Find the requested vector.

41) The velocity at $t = 4$ for $\mathbf{r}(t) = (5t^2 + 3t + 3)\mathbf{i} - 5t^3\mathbf{j} + (5 - t^2)\mathbf{k}$ 41) _____

A) $\mathbf{v}(4) = 23\mathbf{i} - 80\mathbf{j} - 4\mathbf{k}$ B) $\mathbf{v}(4) = 43\mathbf{i} + 240\mathbf{j} + 8\mathbf{k}$

C) $\mathbf{v}(4) = 37\mathbf{i} - 240\mathbf{j} - 8\mathbf{k}$ D) $\mathbf{v}(4) = 43\mathbf{i} - 240\mathbf{j} - 8\mathbf{k}$

42) The acceleration at $t = 2$ for $\mathbf{r}(t) = (4t - 2t^4)\mathbf{i} + (4 - t)\mathbf{j} + (6t^2 - 9t)\mathbf{k}$ 42) _____

A) $\mathbf{a}(2) = 96\mathbf{i} + 12\mathbf{k}$ B) $\mathbf{a}(2) = -24\mathbf{i} + 12\mathbf{k}$

C) $\mathbf{a}(2) = -96\mathbf{i} + 12\mathbf{k}$ D) $\mathbf{a}(2) = -96\mathbf{i} - \mathbf{j} + 12\mathbf{k}$

The vector r(t) is the position vector of a particle at time t. Find the angle between the velocity and the acceleration vectors at time t = 0.

43) $\mathbf{r}(t) = (2t^2 + 4)\mathbf{i} + (5t^3 - 4t)\mathbf{k}$ 43) _____

A) $\frac{\pi}{2}$ B) 0 C) π D) $\frac{\pi}{4}$

For the smooth curve r(t), find the parametric equations for the line that is tangent to r at the given parameter value $t = t_0$.

44) $\mathbf{r}(t) = (5t^2 - 6t)\mathbf{i} + (t + 8)\mathbf{j} + \mathbf{k}$; $t_0 = 2$ 44) _____

A) x = 8 + t, y = t, z = t
B) x = 14t, y = t, z = t
C) x = 8 + 14t, y = 10 + t, z = 1
D) x = 8 + 14t, y = 10 + t, z = 0

Answer Key
Testname: MATH 2013 CAL III PRACTICE QUIZ 1

1) A
2) D
3) D
4) D
5) C
6) B
7) D
8) C
9) A
10) A
11) D
12) A
13) C
14) C
15) A
16) D
17) B
18) A
19) C
20) D
21) B
22) D
23) A
24) C
25) C
26) C
27) B
28) C
29) C
30) C
31) C
32) B
33) C
34) B
35) D
36) D
37) B
38) A
39) B
40) C
41) D
42) C
43) A
44) C