MATHEMATICS SAMPLE QUESTIONS

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1. Determine the value of the parameter c in the equation $x^2 - x + c = 0$, given that the square of the difference of its roots equals 9.

Answer:

a) $c = 2$
b) $c = -1$
c) $c = -3$
d) $c = 3$
e) $c = -2$

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2. For $x = -135^\circ$ compute $\dfrac{\sin(x) + \sin(3x) + \sin(5x)}{\cos(x) + \cos(3x) + \cos(5x)}$.

Answer:

a) 3
b) $\dfrac{1}{3}$
c) -1
d) $\dfrac{3}{2}$
e) -4

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3. In the expansion of the binomial power $\left(x\sqrt[4]{x} - \dfrac{1}{\sqrt[8]{x^5}} \right)^n$ find the term which does not contain x, if it is known that the sum of coefficients of the second and third terms from the right equals 78.

Answer:

a) 75
b) 495
c) 505
d) 675
e) 465

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4. Solve the equation $\left(1-\frac{1}{1+\frac{1}{x}}\right)^2=\frac{81}{100}$.

Answer:

a) $x=\frac{18}{9},\quad x=-\frac{19}{9}$

b) $x=\frac{1}{9},\quad x=-\frac{1}{9}$

c) $x=-\frac{1}{9},\quad x=-\frac{19}{9}$

d) $x=\frac{1}{9},\quad x=-\frac{19}{9}$

e) $x=\frac{19}{9},\quad x=-\frac{19}{9}$

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5. Three numbers are consecutive terms of an increasing geometric progression. Their sum is 28, while the product of the middle number and the sum of the other two numbers is 160. Which are these numbers?

a) Write the least number.
b) Write the greatest number.
c) Write the ratio of the geometric progression.

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6. Solve the equation $tg(x)\,ctg(2x)\,sin(3x)=0$.

Answer:

a) $x=\frac{\pi}{4}+k\pi,\quad x=\pm\frac{4\pi}{3}+4k\pi,\quad k\in Z$

b) $x=\frac{\pi}{4}+k\pi,\quad x=\pm\frac{\pi}{3}+4k\pi,\quad k\in Z$

c) $x=\frac{\pi}{4}+2k\pi,\quad x=\pm\frac{4\pi}{3}+4k\pi,\quad k\in Z$

d) $x=\frac{\pi}{4}+\frac{\pi}{2}k,\quad x=\pm\frac{\pi}{3}+k\pi,\quad k\in Z$

e) $x=\frac{\pi}{4}+2k\pi,\quad x=\pm\frac{4\pi}{3}+k\pi,\quad k\in Z$

A basketball team made 49 successful shots at the basket during a game, and scored 106 points from those shots. Each shot is worth either two or three points. How many three point shots were scored by that team during the game?

Answer:

7.

a) 7
b) 8
c) 2
d) 5
e) 9

Find all values of the parameter p such that the inequality $x^2 + px + 1 > 0$ holds for all real numbers x?

Answer:

8.

a) $-2 < p < 2$
b) $-2 \le x \le 2$
c) $-2 < p, \quad p > 2$
d) $p \le -\sqrt{5}, \quad p \ge \sqrt{5}$
e) $-2 \le p, \quad p \ge 2$

Solve the system of inequations $|x+1| < |x-4| < |2+x|$.

Answer:

9.

a) $\frac{1}{2} < x < \frac{3}{2}$
b) $1 < x < \frac{3}{2}$
c) $1 < x < \frac{5}{3}$
d) $-\frac{1}{2} < x < 2$
e) $-1 < x < \frac{3}{2}$

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10. The segment AB is the diameter of a circle. If the coordinates $A(4,2)$ and $B(2,-2)$ are given, find the points in which that circle intersects the $x-$axis.

Answer:

a) $(1-\sqrt{5},0)$, $(1+\sqrt{5},0)$

b) $(2-\sqrt{5},0)$, $(2+\sqrt{5},0)$

c) $(0,0)$, $(4,0)$

d) $(3-\sqrt{5},0)$, $(3+2\sqrt{5},0)$

e) $(3-\sqrt{5},0)$, $(3+\sqrt{5},0)$

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11. Determine the function $h(x)=(f\circ g)(x)-(g\circ f)(x)$, given that $f(x)=3x+1$ and $g(x)=2x-1$.

Answer:

a) $h(x)=-3\sqrt{2}$

b) $h(x)=x$

c) $h(x)=-3$

d) $h(x)=x-3$

e) $h(x)=5x+2$

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12. If $a^2+b^2=6ab$, what is $\log|a+b|-\log|a-b|$?

Answer:

a) $\frac{1}{2}$

b) -2

c) $2b$

d) $\frac{1}{2}\log 2$

e) $\log 2$

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13. Compute $x-2y$, if x is the sum of first 70 natural numbers, and y is the sum of first 30 natural numbers.

Answer:

a) 1500
b) 1565
c) 1555
d) 1285
e) 2125

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14. Compute

$$\sqrt[3]{14\sqrt{2}+20}+\sqrt[3]{20-14\sqrt{2}}\,.$$

Answer:

a) 4
b) -1
c) 3
d) -2
e) 2

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15. Solve the system of equations $\begin{matrix} y-2|x|=-3 \\ |y|+x=3 \end{matrix}$.

Answer:

a) $(2,1),\quad (0,-3),\quad (-6,9)$
b) $(2,0),\quad (3,-3),\quad (1,2)$
c) $(2,1),\quad (3,-3),\quad (-9,12)$
d) $(2,5),\quad (3,-3),\quad (-6,9)$
e) $(-2,1),\quad (0,-3),\quad (-6,9)$

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16. Solve the equation $\dfrac{x^2+2x+7}{x^2+2x+3}=4+2x+x^2$ in the set of complex numbers.

a) Write the solution with the least modulus.
b) Write the solution with the negative imaginary part.
c) Write the solution with the positive imaginary part.

Solve the equation $\left|x^2-4x-1\right|-\left|x-2\right|=x^2-1$.

17.

d) Write the negative solution.
e) Write the greatest solution.
f) Write the remaining solution.

A pharmacy sells the medicines A and B. Four boxes of the medicine A and two boxes of the medicine B cost 850 dinars, while one box of the medicine A and five boxes of the medicine B cost 1000 dinars? Which medicine is more expensive, and by how much?

18.

g) Write the price of the medicine A.
h) Write the price of the medicine B.
i) Write which medicine is more expensive, and by how much.

Solve the equation $x^3+8=4x^2$.

19.

j) Write the least solution.
k) Write the greatest solution.
l) Write the remaining solution.

If $CD=24\ mm$, $EF=18\ mm$ and if the angles $\angle DCA$, $\angle BAE$ and $\angle AEF$ are right angles, find the length of the segment AB?

Answer:

20.

a) $\frac{68}{9}\ mm$
b) $12\ mm$
c) $10\ mm$
d) $\frac{45}{4}\ mm$
e) $\frac{72}{7}\ mm$