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SOUTHWEST VIRGINIA COMMUNITY COLLEGE  
MATH CONTEST

Algebra III and Trigonometry

# Algebra III & Trigonometry

1. If  $2x + y = 7$  and  $x - 4y = 4$ , then  $y = (?)$

- A  $-\frac{15}{9}$
- B  $-\frac{1}{9}$
- C  $\frac{7}{16}$
- D  $\frac{11}{9}$
- E 7

2. For what real numbers  $x$  does  $3x^2 - x - 4 = 0$ ?

- A -4 and 3
- B  $-\frac{4}{3}$  and 1
- C  $-\frac{2}{3}$  and 2
- D  $\frac{2}{3}$  and 2
- E  $\frac{4}{3}$  and -1

3. The lowest common denominator of the fractions

$$\frac{1}{s^2 + s - 12} \text{ and } \frac{1}{s^2 - 5s + 6} \text{ is}$$

- A  $(s - 2)(s - 3)(s + 4)$
- B  $(s - 2)(s - 3)^2(s + 4)$
- C  $(s - 2)(s + 3)(s - 4)$
- D  $(s - 2)(s - 3)(s + 3)(s - 4)$
- E  $(s + 2)(s - 3)(s + 3)(s - 4)$

4. If  $m = \sqrt{3}$ , then  $m^{-4} = (?)$

- A. -9
- B.  $\frac{1}{81}$
- C.  $\frac{1}{9}$
- D. 3
- E. 9

5. If  $\frac{a^2}{r+t} = m$ , and if  $m \neq 0$ , then  $r = (?)$

A  $a^2 - t^2$

B  $\frac{m}{a^2} - t$

C  $\frac{a^2 - t}{m}$

D  $\frac{a^2 - mt}{m}$

E  $\frac{a^2 + mt}{m}$

6. For what value of  $k$  is  $x - 1$  a factor of  $3x^5 - k$ ?

A  $-3$

B  $\frac{1}{3}$

C  $\frac{5}{3}$

D  $3$

E  $5$

7.  $(t + i)^2 = (?)$

A  $0$

B  $2$

C  $2i$

D  $1 + i$

E  $2 + 2i$

8. If  $x = -3$  is one solution of the equation  $x^2 + x + c = 0$ , then  $c = (?)$

A  $-12$

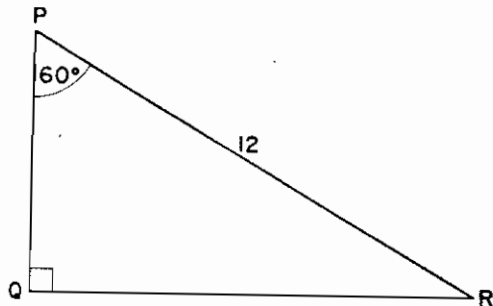
B  $-6$

C  $2$

D  $3$

E  $6$

9.



What is the length of side QR in right triangle PQR in the figure above?

A  $3\sqrt{2}$

B  $6$

C  $6\sqrt{2}$

D  $6\sqrt{3}$

E  $12$

10. If  $0^\circ \leq x \leq 90^\circ$  and if  $\cos x - .5 = 0$ , then  $x = (?)$

- A  $0^\circ$
- B  $1^\circ$
- C  $30^\circ$
- D  $45^\circ$
- E  $60^\circ$

11. The altitude of a balloon R above the level ground is 1000 ft. If a weather station at point P on the ground sights the balloon at an angle of  $58^\circ$ , the distance RP is

- A  $\frac{1000}{\sin 58^\circ}$
- B  $\frac{1000}{\cos 58^\circ}$
- C  $1000 \sin 58^\circ$
- D  $1000 \cos 58^\circ$
- E  $1000 \tan 32^\circ$

12. If  $x + y = \frac{\pi}{2}$  radians, which of the following is true?

- A  $\sin x = \cos y$
- B  $\tan x = \tan y$
- C  $\cos x = \cos y$
- D  $\sin x = \sin y$
- E  $\sin x = \tan y$

13.  $\sin^2 2\theta + \cos^2 2\theta = (?)$

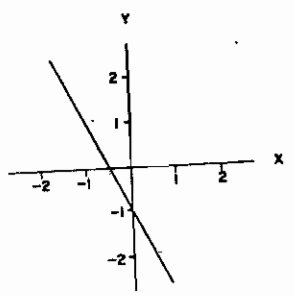
- A. 0
- B. 1
- C. 2
- D.  $\cos 4\theta$
- E.  $1 - 2 \sin 4\theta$

14.  $\begin{vmatrix} 4 & 2 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix} = (?)$

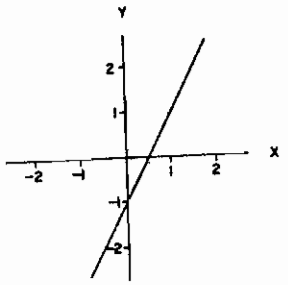
- A -2
- B 0
- C 2
- D 7
- E 9

15. Which of the following is the graph of the set of points  $(x, y)$  in the plane for which the  $y$ -coordinate of each point is one less than twice the  $x$ -coordinate?

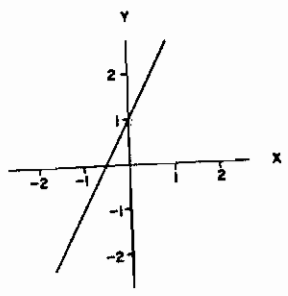
A



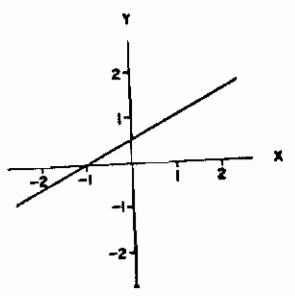
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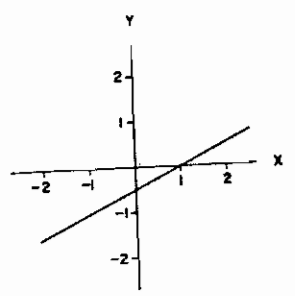
C



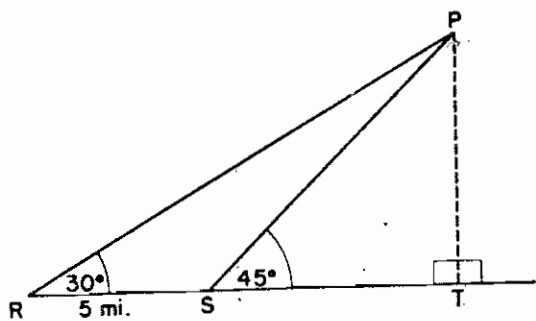
D



E



16.



In the figure above,  $\angle R = 30^\circ$ ,  $RS = 5$  miles,  $\angle TSP = 45^\circ$ , and  $PT$  is an altitude of triangle RSP. The length of  $PT$  to the nearest mile is

- A 3
- B 4
- C 5
- D 7
- E 9

17.  $\sin 20^\circ - \cos 70^\circ = (?)$

- A. -1
- B. 0
- C. 1
- D.  $-\cos 50^\circ$
- E.  $\sin(-50^\circ)$

18. Every fifth degree polynomial with real coefficients must have how many real roots?

- A. 0
- B. At least 1
- C. At least 2
- D. 3
- E. 5

19. If  $\log x = \log 1 + \log 2 + \log 3 + \log 4 + \log 5$ , then  $x = (?)$ 

- A 6
- B 15
- C 36
- D 55
- E 120

20. If  $\theta$  is the acute angle for which  $\sin \theta = \frac{3}{5}$ , then  $\sin 2\theta = (?)$ 

- A  $\frac{6}{5}$
- B  $\frac{24}{25}$
- C  $\frac{12}{25}$
- D  $\frac{9}{25}$
- E  $\frac{7}{25}$

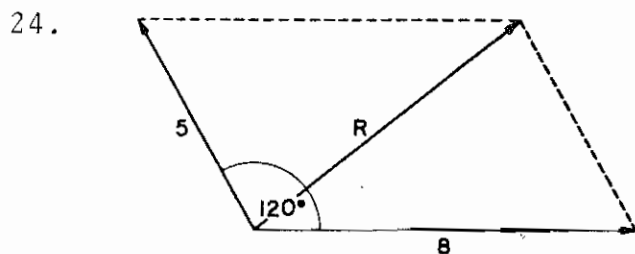
21. The period of the function  $f(x) = \sin x$  is
- A.  $\frac{\pi}{2}$   
 B.  $\pi$   
 C.  $2\pi$   
 D.  $3\pi$   
 E.  $4\pi$
22. If  $(2, -3)$  and  $(-6, 9)$  are ordered pairs of real numbers of the form  $(x, mx + b)$ , then  $m = (?)$

- A.  $-\frac{3}{2}$   
 B.  $-\frac{2}{3}$   
 C.  $-\frac{1}{2}$   
 D.  $\frac{2}{3}$   
 E.  $\frac{3}{2}$

23. Which of the following is (are) true for all values of  $\theta$  for which the functions are defined?

- I.  $\sin(-\theta) = -\sin \theta$   
 II.  $\cos(-\theta) = -\cos \theta$   
 III.  $\tan(-\theta) = -\tan \theta$

- A. I only  
 B. II only  
 C. III only  
 D. I and III only  
 E. II and III only



The figure above represents two forces, 5 and 8 pounds respectively, which act on the same point and make an angle of  $120^\circ$  with each other. What is the magnitude, in pounds, of the resultant force  $R$ ?

- A. 3  
 B.  $\frac{13}{2}$   
 C. 7  
 D.  $\sqrt{109}$   
 E.  $\sqrt{129}$

25. If  $2 \cos^2 \theta - 5 \cos \theta + 2 = 0$  and  $\theta$  is an acute angle, then  $\theta = (?)$
- A.  $15^\circ$
  - B.  $30^\circ$
  - C.  $45^\circ$
  - D.  $60^\circ$
  - E.  $90^\circ$
26. The graph of  $y = 4 - \cos 3x$  crosses the Y-axis at the point where  $y = (?)$
- A -1
  - B 1
  - C 3
  - D 4
  - E 5
27. Which of the following is equivalent to  $\cos(x - y) - \cos(x + y)$ ?
- A  $-2 \cos y$
  - B  $-2 \cos x \cos y$
  - C  $-2 \sin x \sin y$
  - D  $2 \cos x \cos y$
  - E  $2 \sin x \sin y$
28. If 2, 6, 18,  $3x + 3$  are the first four terms of a geometric sequence, then  $x = (?)$
- A. 5
  - B. 7
  - C. 9
  - D. 11
  - E. 17
29. If  $\log_{10} n = 1.9682$ , then  $\log_{10} 100n = (?)$
- A. 1.0316
  - B. 2.9682
  - C. 3.9682
  - D. 3.9364
  - E 196.82
30.  $\frac{3 + 2i}{i} = (?)$
- A 1
  - B 5
  - C  $5i$
  - D  $-2 + 3i$
  - E  $2 - 3i$



31. If  $f(x) = 4x + 3$  and  $g(x) = x^2 - 2$ , then

$$f(g(x)) = (?)$$

A.  $-x^2 + 4x + 5$

B.  $x^2 + 4x + 1$

C.  $4x^2 - 8$

D.  $4x^2 - 5$

E.  $4x^2 + 1$

32. If the graph of the equation  $cy = dx^2 - 4$  passes through the points  $(2, 0)$  and  $(-4, 3)$ , then  $c = (?)$

A 4

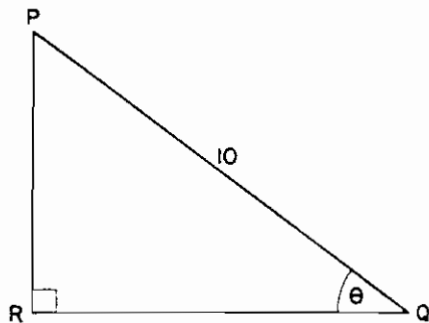
B 0

C  $-\frac{9}{2}$

D  $-\frac{20}{3}$

E -20

33.



In right triangle PQR above, the hypotenuse is 10 and  $\tan \theta = \frac{3}{4}$ . What is the area of triangle PQR?

A. 6

B. 15

C. 24

D. 30

E. 48

34.  $|x - 2| < 4$  if and only if

A.  $x < 2$

B.  $x < 6$

C.  $x > -2$

D.  $-2 < x < 6$

E.  $x < -2$  and  $x > 6$

35. If  $90^\circ < \alpha < 180^\circ$  and  $180^\circ < \beta < 270^\circ$ , then which of the following is possible?

A.  $\sin \alpha = \tan \beta$

B.  $\tan \alpha = \tan \beta$

C.  $\sin \alpha = \cos \beta$

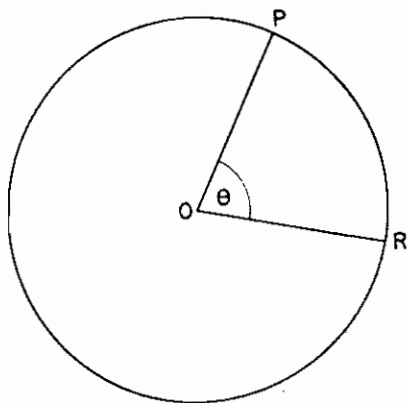
D.  $\sin \alpha = \sin \beta$

E.  $\cos \alpha = \tan \beta$

36. If  $x$  is a positive angle less than  $180^\circ$ , what are all values of  $x$  for which  $|\cos x| < |\sin x|$ ?
- A. No value
  - B.  $45^\circ < x < 90^\circ$
  - C.  $45^\circ < x < 135^\circ$
  - D.  $90^\circ < x < 180^\circ$
  - E.  $0^\circ < x < 45^\circ$  and  $135^\circ < x < 180^\circ$

37. If  $0^\circ \leq x \leq 180^\circ$ , and if  $\cos x = -\sin x$ , then  $x =$  (?)
- A.  $0^\circ$
  - B.  $45^\circ$
  - C.  $60^\circ$
  - D.  $90^\circ$
  - E.  $135^\circ$

38.



In the figure above, if the radius of circle  $O$  is 4 and the length of arc  $PR$  is  $2\pi$ , what is the radian measure of  $\angle POR$ ?

- A.  $\frac{1}{4}$
  - B.  $\frac{1}{2}$
  - C.  $\frac{\pi}{4}$
  - D.  $\frac{\pi}{2}$
  - E.  $\frac{2}{\pi}$
39. What is the smallest positive value of  $t$  for which  $\sin(3t - 45^\circ) = 0$ ?
- A.  $-15^\circ$
  - B.  $0^\circ$
  - C.  $15^\circ$
  - D.  $45^\circ$
  - E.  $135^\circ$

40. If  $\tan x = .80$ , then  $\cot x =$  (?)
- A. .20
  - B. .25
  - C. .80
  - D. 1.20
  - E. 1.25