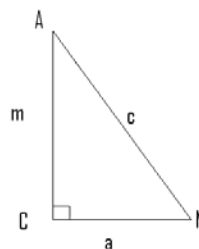




- It is given that  $K = C + 273$  and  $F = \frac{9}{5}C + 32$ . If  $F = -40$ , evaluate  $K$ .  
a) 8582                      b) 352                      c) 256                      d) 233                      e) NOTA
- Which of the following plots as a straight line on a polar coordinate system?  
a)  $r = \cos \theta$                       b)  $\theta = \pi$                       c)  $r = \theta$                       d)  $r = 1$                       e) NOTA
- At how many points does the plot of  $f(x) = |x - 1| - 1$  intersect the plot of  $g(x) = [x]$ ?  
Note:  $g(x)$  is the **greatest integer function**.  
a) 1                      b) 0                      c) 2                      d)  $\infty$                       e) NOTA
- If  $\begin{bmatrix} x \\ y \end{bmatrix}$  represents the point  $(x, y)$  on a rectangular coordinate system, which of the following matrices will reflect the point  $(x, y)$  about the line  $y = x$  when left multiplied?  
a)  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$                       b)  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$                       c)  $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$                       d)  $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$                       e) NOTA
- Which of the following terms describe the number  $e$ ?  
I. Real                      II. Complex                      III. Irrational                      IV. Transcendental                      V. Natural  
a) I, III, IV only                      b) I, II, III, IV only                      c) I, III only                      d) I, III, IV, V only                      e) NOTA
- In the right triangle shown, express  $\sin\left(\frac{1}{2}A\right)$  in terms of side lengths  $a$ ,  $c$ , and  $m$ .



- $\sqrt{\frac{c-a}{2c}}$                       b)  $\sqrt{\frac{c+m}{2c}}$                       c)  $\sqrt{\frac{c-m}{2c}}$                       d)  $\sqrt{\frac{c+a}{2c}}$                       e) NOTA



7. Given:  $\log 2 = a$ ,  $\log 17 = b$ ,  $\log 59 = c$ . Express  $\log_{2006} 425$  in terms of  $a$ ,  $b$ , and  $c$ .

- a)  $\frac{100+b-2a}{a+b+c}$     b)  $\frac{2+b-2a}{a+b+c}$     c)  $\frac{2+b-a^2}{a+b+c}$     d)  $\frac{b-a^2-2}{a+b+c}$     e) NOTA

8. Calculate the volume of the parallelepiped defined by the following vectors:

$$\vec{u} = \langle 3, 7, -4 \rangle; \vec{v} = \langle 5, 9, -8 \rangle; \vec{w} = \langle 6, 0, -7 \rangle$$

- a) 32    b) 12    c) 10    d) 8    e) NOTA

9. Identify the conic section defined by the following polar equation:  $r = \frac{12}{2 + 4 \sin \theta}$ .

- a) parabola    b) ellipse    c) circle    d) hyperbola    e) NOTA

10. How many dots are necessary to draw the 22<sup>nd</sup> decagonal number?

**Hint:** The answer is also the year in which Colorado State University was founded.

- a) 1701    b) 1876    c) 1870    d) 1540    e) NOTA

11. Given:  $Z = K \frac{P}{g}$ , where  $p$  is measured in units of  $N/m^2$ ,  $g$  has units in  $m/s^2$ , and  $1 = \frac{kg \cdot m}{N \cdot s^2}$ .

Determine the units of  $K$  such that  $Z$  has units in  $m$ .

- a)  $m^3/kg$     b)  $kg/m^3$     c)  $kg^3/m$     d)  $m/kg^3$     e) NOTA

12. Use Descartes' Rule of Signs to determine number of possible **negative** real zeros for  $f(x)$ .

$$f(x) = x^4 + 2x^3 - x^2 + 8x - 1$$

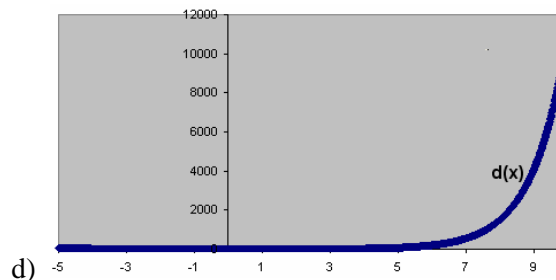
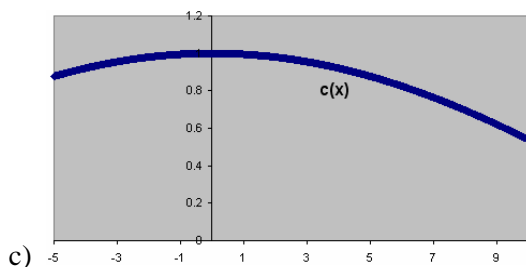
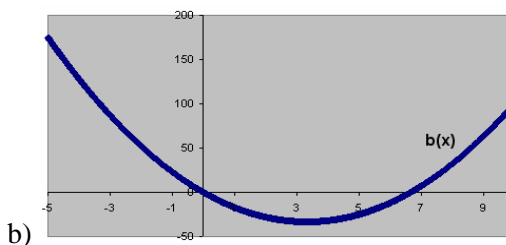
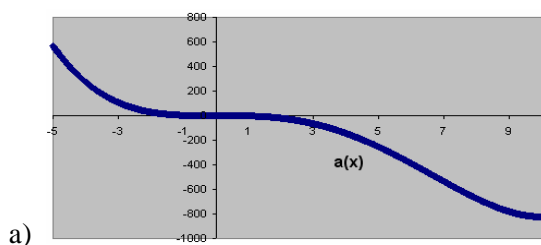
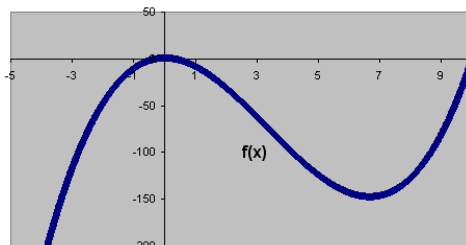
- a) 3    b) 1    c) 3 or 1    d) 5 or 3 or 1    e) NOTA

13. To which of the following curves is  $f(x) = \frac{x^3 - x^2 + 2}{x + 1}$  asymptotic as  $x \rightarrow \pm\infty$ ?

- a)  $y = x^3$     b)  $y = x^2 - 2x + 2$     c)  $y = x$     d)  $y = x - 2$     e) NOTA



14. For every  $x$ ,  $f(x)$  (shown below) represents the **slope** of  $g(x)$ . Which of the following functions could most closely resemble  $g(x)$ ?



e) NOTA

15. Suppose the  $n^{\text{th}}$  derivative of  $f(x) = \sin x$  with respect to  $x$  can be found by horizontally shifting  $f$  ( $n\pi/2$ ) units to the left ( $n$  is a natural number). Simplify 2006<sup>th</sup> derivative of  $f$  with respect to  $x$ ?

a)  $-\sin x$       b)  $-\cos x$       c)  $\cos x$       d)  $\sin x$       e) NOTA

16. Evaluate the infinite sum:  $\frac{1}{6} + \frac{2}{36} + \frac{3}{216} + \frac{4}{1296} + \dots$

a)  $6/25$       b)  $6/5$       c)  $5/6$       d)  $5/3$       e) NOTA

17. Simplify:  $\lim_{h \rightarrow 0} \frac{(x+h)^{2006} - x^{2006}}{h}$

a)  $2007x^{2006}$       b)  $2005x^{2006}$       c)  $2006x^{2007}$       d)  $2006x^{2005}$       e) NOTA



18. Two sets are equivalent if they have the same number of elements. Equivalence for infinite sets can be proved by placing elements of the sets in a one-to-one correspondence. Which of the following pairs of sets are **unequal**?
- a) even integers; odd integers                      b) negative integers; real numbers  
c) prime numbers; positive integers              d) perfect squares; perfect cubes                      e) NOTA
19. Four boxes each contain 5 objects. The first box contains 1 green object and 4 gold objects, the second 2 green and 3 gold, the third 3 green and 2 gold, and the fourth 4 green and 1 gold. One of the boxes is chosen at random and 2 objects are drawn from it without replacement. What is the probability that both objects are gold?
- a) 1/5                      b) 1/4                      c) 1/2                      d) 1/3                      e) NOTA
20. Given the true implication: "If you clean your room, then you get the car." Which of the following statements is false?
- a) You don't clean your room or you get the car.  
b) Cleaning your room is a sufficient condition for you to get the car.  
c) You clean your room and you don't get the car.  
d) If you didn't get the car, then you didn't clean your room.  
e) NOTA
21. Suppose  $5 - 12i = (a + bi)^2$ , where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ . Find the possible values of  $b$ .
- a) -2                      b) 3                      c) 3, -3                      d) -2, 2                      e) NOTA
22. Find the quotient  $x/y$  in  $a+bi$  form if  $x = 6\sqrt{3} \operatorname{cis} 105^\circ$  and  $y = 3 \operatorname{cis} 45^\circ$ .
- a)  $\sqrt{6} + 3i$                       b)  $3 + \sqrt{6}i$                       c)  $\sqrt{3} - 3i$                       d)  $3 + \sqrt{3}i$                       e) NOTA
23. Given  $x - 5y + z + 3 = 0$ , find the minimum value of  $\sqrt{x^2 + y^2 + z^2}$ .
- a) 0                      b) 1/2                      c)  $\sqrt{3}/3$                       d)  $\sqrt{6}/2$                       e) NOTA
24. The current in the Colorado River has a speed of about 3 mph. Mary can paddle her kayak 24 miles upstream and 24 miles back to the starting point in the same time that she can paddle 50 miles in still water. What is Mary's speed in still water (in mph)?
- a) 15                      b) 10                      c) 5                      d) 3                      e) NOTA



25. Which of the following statements are true for all  $n$ ,  $n \in$  Natural Numbers?

I.  $n^3 - n$  is divisible by 6                      II.  $2 < 2^n$                       III.  $\cos(n\pi) = (-1)^n$

- a) III only                      b) I, III only                      c) I, II only                      d) I, II, III                      e) NOTA

26. Cosmo uses Cramer's rule to solve the following system of linear equations:

$$9x + 6y - 8z = 0$$

$$2x + 1y - 8z = 1$$

$$2x + 0y + 0z = 6$$

Which of the following will correctly solve for  $z$ ?

a)  $\frac{\begin{vmatrix} 9 & 6 & 1 \\ 2 & 1 & 0 \\ 2 & 0 & 6 \end{vmatrix}}{\begin{vmatrix} 9 & 6 & -8 \\ 2 & 1 & -8 \\ 2 & 0 & 0 \end{vmatrix}}$                       b)  $\frac{\begin{vmatrix} 9 & 0 & -8 \\ 2 & 1 & -8 \\ 2 & 6 & 0 \end{vmatrix}}{\begin{vmatrix} 9 & 6 & -8 \\ 2 & 1 & -8 \\ 2 & 0 & 0 \end{vmatrix}}$                       c)  $\frac{\begin{vmatrix} 0 & 6 & -8 \\ 1 & 1 & -8 \\ 6 & 0 & 0 \end{vmatrix}}{\begin{vmatrix} 9 & 6 & -8 \\ 2 & 1 & -8 \\ 2 & 0 & 0 \end{vmatrix}}$                       d)  $\frac{\begin{vmatrix} 9 & 6 & -8 \\ 2 & 1 & -8 \\ 2 & 0 & 0 \end{vmatrix}}{\begin{vmatrix} 9 & 6 & 0 \\ 2 & 1 & 1 \\ 2 & 0 & 6 \end{vmatrix}}$                       e) NOTA

27. What is the domain of  $f$  if  $f(x) = \sqrt{(x-17)(x+2)(x-34)}$ ?

- a)  $(-\infty, -59) \cup (34, \infty)$                       b)  $(-\infty, 34] \cap [59, \infty)$                       c)  $[-2, 17] \cup [34, \infty)$   
d)  $(-\infty, -59] \cap [34, \infty)$                       e) NOTA

28. Simplify :  $\tan \theta + \frac{\cos \theta}{1 + \sin \theta}$

- a)  $\sin \theta$                       b)  $\cos \theta$                       c)  $\sec \theta$                       d)  $1 + \sin \theta$                       e) NOTA

29. If  $\sin\left(\text{Arc sin } \frac{12}{13} + \text{Arc sin } \frac{4}{5}\right) = \frac{a}{b}$ , where  $a$  and  $b$  are relatively prime, find  $a + b$ .

- a) 152                      b) 121                      c) 85                      d) 78                      e) NOTA

30. Find the equation for the directrix for the parabola  $(x - h)^2 = 4p(y - k)$ . Assume  $p > 0$ .

- a)  $y = k - p$                       b)  $x = h - p$                       c)  $y = k - 2p$                       d)  $x = h - 2p$                       e) NOTA