

5. Find $\frac{d^2h}{dx^2}$ if $h(x) = \sqrt{1+x^2}$.

(A) $(1+x^2)^{-1/2} + \frac{1}{2}x^2(1+x^2)^{-3/2}$ (B) $(1+x^2)^{-1/2} - \frac{1}{2}(1+x^2)^{-3/2}$

(C) $(1+x^2)^{-3/2}$ (D) $x(1+x^2)^{-1/2}$

(E) $(1+x^2)^{-1/2} + x^2(1+x^2)^{-3/2}$

6. Find the number of real solutions to the equation $x = e^{\sin(\ln x)}$

(A) 0 (B) 1 (C) 2

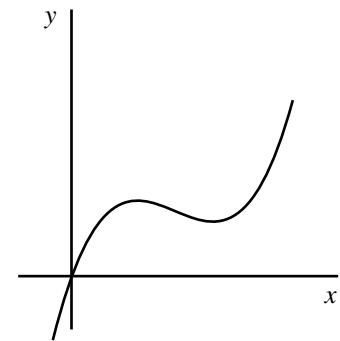
(D) 3 (E) infinitely many

7. A bathroom tub will fill in 12 minutes with both faucets open and the stopper in place. With both faucets closed and the stopper removed, the tub will empty in 20 minutes. How long will it take for the tub to fill if both faucets are open and the stopper removed?

(A) 30 minutes (B) 60 minutes (C) 20 minutes

(D) 45 minutes (E) 15 minutes

8. The graph of $y = Ax^3 + Bx^2 + Cx + D$ appears in the accompanying figure. Find the true statement.



(A) $D < 0$ (B) $B + C + D \leq 0$

(C) $B - C + D \leq 0$ (D) $A^2 - 4BD + C^2 < 0$

(E) $A^2 - 2AC + C^2 < 0$

9. What is $\cos\left(\frac{2\pi}{5}\right) + \cos\left(\frac{4\pi}{5}\right) + \cos\left(\frac{6\pi}{5}\right) + \cos\left(\frac{8\pi}{5}\right) + \cos\left(\frac{10\pi}{5}\right)$?

(A) $-\frac{1}{2}$ (B) 0 (C) $\frac{1}{5}$ (D) 1 (E) 2

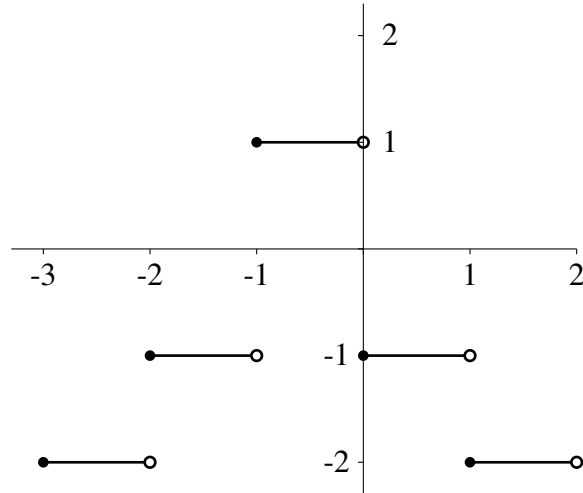
10. Let

$$f(x) = \begin{cases} 1 & \text{if } -1 \leq x < 0, \\ -1 & \text{if } 0 \leq x < 1, \\ 0 & \text{otherwise.} \end{cases} \text{ and}$$

The accompanying figure shows the graph of

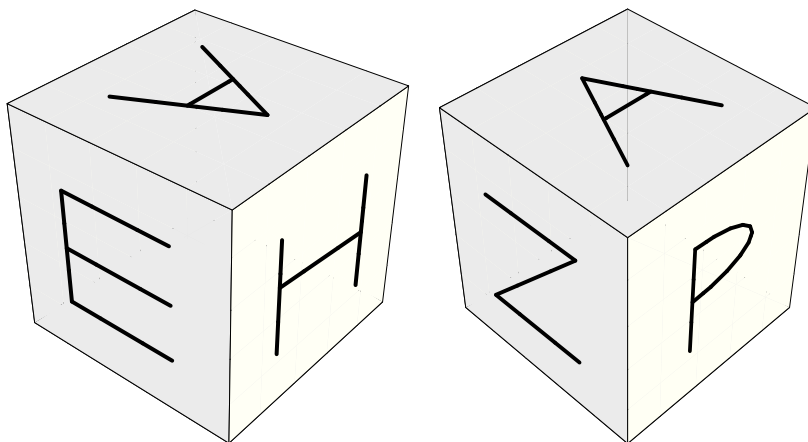
$$g(x) = af(x - 2) + bf(x - 1) + cf(x) + df(x + 1) + ef(x + 2)$$






on the interval $[-3, 2)$. Find $g(2.5)$.



- (A) 0 (B) -2 (C) 3 (D) -4 (E) 5

11. A child's block has a different letter of the alphabet on each of its six faces. Shown below are two different views of the same block. Which of the choices could be the same block viewed from yet another angle?



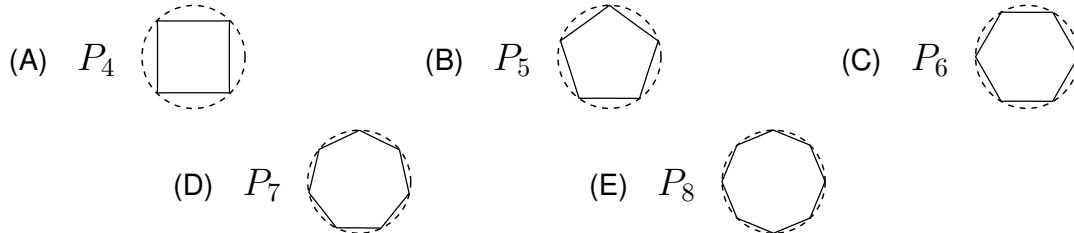
- (A)  (B)  (C)  (D)  (E) 

12. Choose the number closest to the sum

$$\sum_{n=1}^{5000} \frac{2^{5001}}{4^n + 2^{5001}}$$

- (A) 2000 (B) 2500 (C) 3000 (D) 3250 (E) 3500

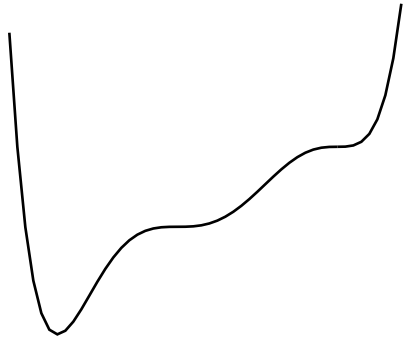
13. Let P_n be a regular n -gon of sufficient size that it can be inscribed in a unit circle. In which of P_4, P_5, \dots, P_8 can we draw the triangle with the largest area?



14. $p(x)$ is a polynomial. If $p(0) = 0$ and $p(x+1) - p(x-1) = x^2$, find $p(1)$.

- (A) 0 (B) $1/3$ (C) $1/2$ (D) $2/3$ (E) $5/6$

15. Fill in the blank with the largest possible number (that makes the sentence true): "The degree of the polynomial graphed in the accompanying figure is at least ____"



- (A) 4. (B) 6. (C) 8. (D) 10. (E) 12.

16. $\sqrt{29 - 12\sqrt{5}}$ can be written as $a + b\sqrt{5}$, where a and b are integers. What's $a^2 + b^2$?

- (A) 5 (B) 7 (C) 25
(D) 41 (E) none of these

17. Let P be the first quadrant point on the graph of $y = \frac{1}{x+1}$ at which the tangent line to the graph forms a 30° - 60° - 90° triangle with the x and y axes. What is the x coordinate of P ?

- (A) $\sqrt{2} + 1$ (B) $\sqrt{3} - 1$ (C) $\frac{1}{\sqrt[4]{3}} - 1$ (D) $1 - \frac{1}{\sqrt[4]{2}}$ (E) $\sqrt[4]{3} - 1$

18. Simplify $\tan(\tan^{-1} x - \cot^{-1} x)$.
- (A) $x^2 - \frac{1}{x^2}$ (B) $\frac{x^2 - 1}{2x}$ (C) $\frac{1}{2} \left(x + \frac{1}{x} \right)$
(D) $\sqrt{1 - x^2}$ (E) $\frac{1}{1 + x^2}$
19. For how many positive integers n will $3n^2 - 80n - 83$ be prime?
(A) none (B) 1 (C) 3
(D) 83 (E) infinitely many
20. If x is a real number and $\cos^4 x - 2 \cos^2 x + \frac{1}{7} = 0$, what is $\sin^2 x$?
(A) $\frac{1}{7}$ (B) $\sqrt{\frac{1}{7}}$ (C) $\frac{\sqrt{5}}{7}$ (D) $\sqrt{\frac{6}{7}}$ (E) $\frac{7}{5}$
21. Which of the following numbers is largest?
(A) $\log_3 6$ (B) $\log_4 8$ (C) $\log_5 10$
(D) $\log_6 12$ (E) They are all equal.
22. In how many ways can a straight line separate a square into two congruent parts?
(A) 1 (B) 2
(C) 3 (D) 4
(E) An infinite number of ways.
23. Right now, there is a room here at the College where nineteen students are taking this test. Eleven of them are from South Carolina. Ten of the students are female. Only two of the male students in the room are from *outside* South Carolina. How many of the students in the room are female and from South Carolina?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4
24. Three friends jog regularly in a park: Anna jogs every 10 days, Barbara jogs every 15 days, and Jo jogs every 14 days. One Sunday they happen to jog together. After how many days will the three friends jog together again?
(A) 150 (B) 210 (C) 350 (D) 420 (E) Never
25. The line segment joining the points $(0,120)$ and $(200,0)$ contains how many points having both coordinates as integers?
(A) 20 (B) 31 (C) 40
(D) 41 (E) none of these

2010 Answers / Level 3 Test

1. A
2. D
3. E
4. A
5. C
6. B
7. A
8. D
9. B
10. E
11. D
12. B
13. C
14. A
15. B
16. E
17. E
18. B
19. B
20. D
21. A
22. E
23. E
24. B
25. D