## PMATH 12 - FINAL REVIEW QUESTIONS

Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. *Divide: $(-4x^2 + 22x + 12) \div (x - 6)$

    A. $4x + 6$ **B.** $4x - 48$ **C.** $-4x + 12$ **D.** $-4x - 2$

2. *What is the remainder when $x^3 + 4 - 11x + 3x^2$ is divided by $6 + x$?

    A. 70   **B.** -62 **C.** -38 **D.** 46

3. *For the polynomial $P(x) = -3x^2 - 4x - 5$, what is the value of $P(-2)$?

    A. -25 **B.** 15   **C.** -21 **D.** -9

4. Which two binomials are factors of $x^4 + 8x^3 + 7x^2 - 40x - 60$?

    A. $x + 2$ and $x - 6$ **C.** $x - 2$ and $x + 6$
    B. $x - 2$ and $x - 6$ **D.** $x + 2$ and $x + 6$

5. Use graphing technology. Graph the polynomial function $f(x) = x^3 - 7x^2 + 11x - 5$.
   Which characteristics apply to the graph?

A. Number of x-intercepts: 3 Number of hills: 1 Number of valleys: 1	**C.** Number of x-intercepts: 2 Number of hills: 1 Number of valleys: 1
B. Number of x-intercepts: 2 Number of hills: 2 Number of valleys: 1	**D.** Number of x-intercepts: 1 Number of hills: 1 Number of valleys: 2

6. *The graph of a polynomial function of degree 4 is shown. Which statements are true?
    i)   The function has an even degree.
    ii) The function has a zero of multiplicity 2.
    iii) The equation of the function has a negative leading coefficient.
   iv) The y-intercept is positive.
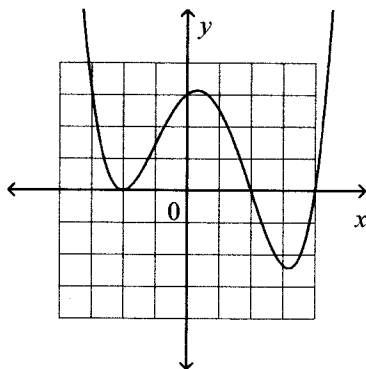
    A. i, ii, iii   **B.** i, iii, iv   **C.** ii, iii, iv   **D.** i, ii, iv

7. *Determine the zeros of the polynomial function $f(x) = (x+2)^4(x-5)$. State the multiplicity of each zero.

    A. The zero 4 has multiplicity 2; the zero 1 has multiplicity –5.
    B. The zero 4 has multiplicity –2; the zero 1 has multiplicity 5.
    C. The zero –2 has multiplicity 4; the zero 5 has multiplicity 1.
    D. The zero 2 has multiplicity 4; the zero –5 has multiplicity 1.

8. Use graphing technology to solve: $\sqrt{3x-1} = -x+5$
   Give the solution to the nearest tenth.

    A. $x \doteq 10.5$ B. $x \doteq 10.8$ C. $x \doteq 2.2$ D. $x \doteq 2.5$

9. *The graph of which function below has a hole?

    A. $y = \dfrac{x+2}{x^2+2}$ B. $y = \dfrac{x^2-9}{x+3}$ C. $y = \dfrac{x^2}{x-4}$ D. $y = \dfrac{x^2-3}{x^2-2}$

10. *What is the equation of the vertical asymptote of the graph of this function?
$$y = \frac{x+4}{x^2+10x+25}$$

    A. $x = -5$ C. $x = -4$
    B. $x = 0$ D. The graph has no vertical asymptote.

11. What is the solution of this rational equation, to the nearest tenth if necessary?
$$\frac{4}{x-1} = -8$$

    A. $x \doteq 1.5$ B. $x \doteq 0.5$ C. $x \doteq -1.5$ D. $x \doteq -0.5$

12. *State the domain of this function.
$$y = \frac{x^2+7x+10}{-2-x}$$

    A. $x \neq \pm 2$ B. $x \neq -2$ C. $x \neq -2, x \neq -5$ D. $x \in \mathbb{R}$

13. *The graph of $y = f(x)$ is translated 4 units down. What is the equation of the translation image in terms of the function f?

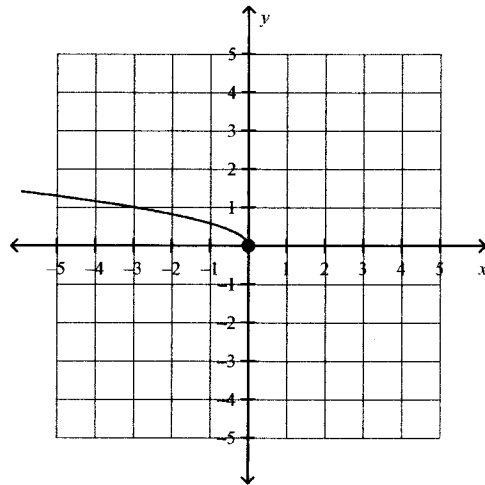   A. $y = f(x+4)$ B. $y + 4 = f(x)$ C. $y - 4 = f(x)$ D. $y = f(x-4)$

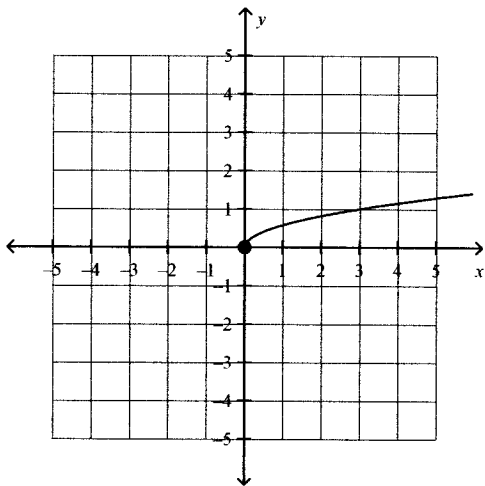**14.** *For the graph of $y = f(x)$ shown below, which graph best represents $y = \sqrt{f(x)}$?
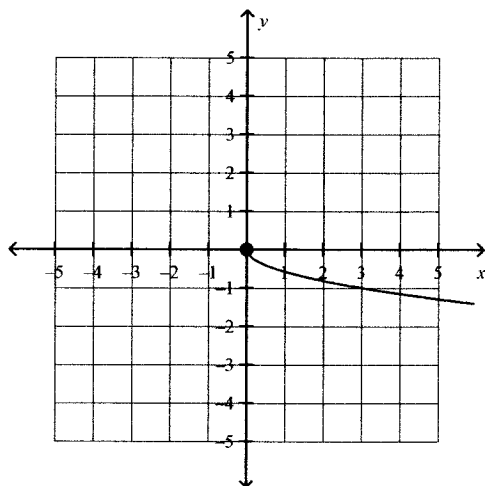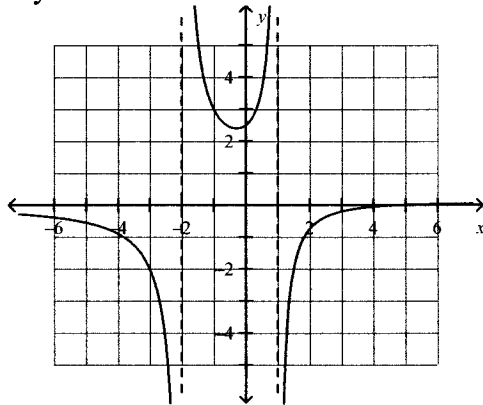
$y = f(x)$
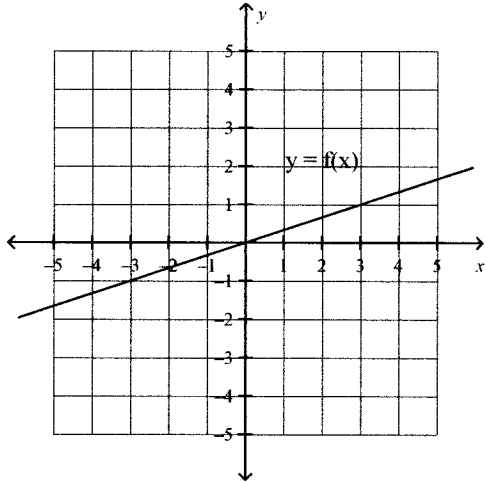
A.
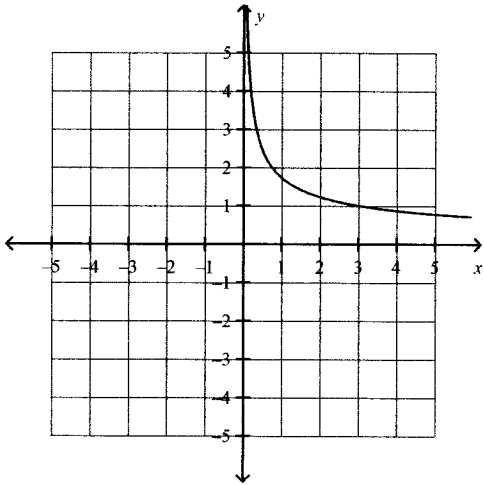
C.

B.

D.

15. *For the graph of this rational function, state the domain and write the equations of any asymptotes and the coordinates of any hole.

$$y = \frac{x-5}{x^2+x-2}$$

A. domain: $x \neq 1$ and $x \neq -2$;
vertical asymptotes: $x = 1$, $x = -2$;
horizontal asymptote: $y = 1$

C. domain: $x \neq 0$;
hole: $(0, -7)$
vertical asymptote: $x = 0$;
horizontal asymptote: $y = 0$

B. domain: $x \neq 1$ and $x \neq -2$;
hole: $(-2, -7)$
vertical asymptote: $x = 1$;
horizontal asymptote: $y = 0$

D. domain: $x \neq 1$ and $x \neq -2$;
vertical asymptotes: $x = 1$, $x = -2$;
horizontal asymptote: $y = 0$

16. *Which function below describes this graph?
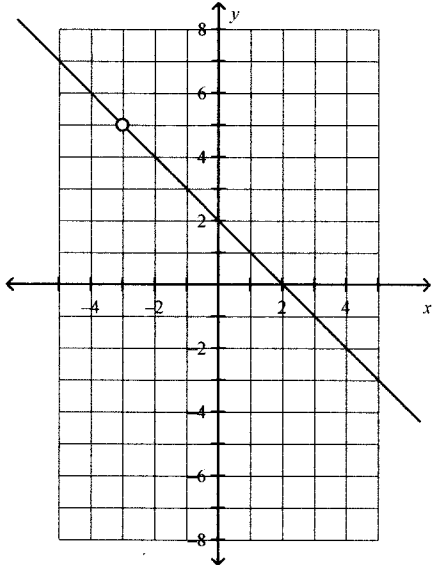
A. $y = \dfrac{-x^2 - x + 6}{x - 3}$

C. $y = \dfrac{-x^2 + 6x + 1}{x + 3}$

B. $y = \dfrac{-x^2 - x + 6}{x + 3}$

D. $y = \dfrac{x + 3}{-x^2 - x + 6}$

17. *The graph of $y = \sqrt{x} + k$ is the image of the graph of $y = \sqrt{x}$ after a single translation. What is the value of k?
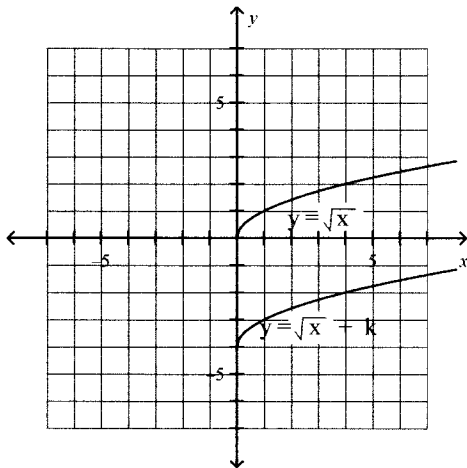
A. 5   **B.** −4   **C.** 4   **D.** −5

18. *The graph of $y = f(x)$ is the image of the graph of $y = -|x|$ after a horizontal and vertical translation. What is an equation of the image graph?
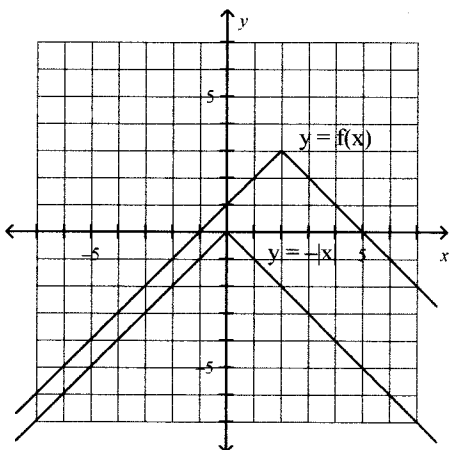
A. $y - 3 = -|x|$ **B.** $y - 3 = -|x - 2|$ **C.** $y - 3 = |x + 2|$ **D.** $y - 2 = -|x - 3|$

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19. *Here is the graph of $y = f(x)$. What are the domain and range of its image after a reflection in the x-axis?

A. domain:
   $-10 \le x \le -2$
   range:
   $-8 \le y \le -2$

B. domain:
   $2 \le x \le 10$
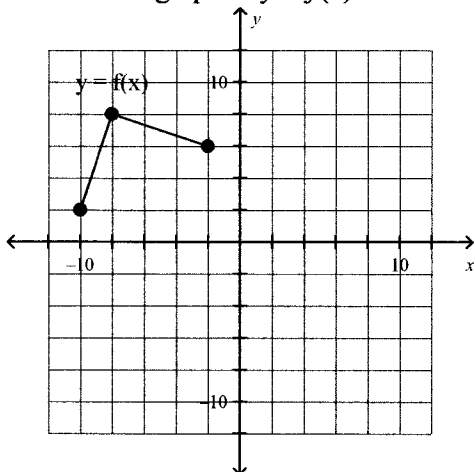   range: $2 \le y \le 8$

C. domain:
   $2 \le x \le 10$
   range:
   $-8 \le y \le -2$

D. domain:
   $-10 \le x \le -2$
   range: $2 \le y \le 8$

20. *Here is the graph of $y = f(x)$. What are the domain and range of $y = -f(x)$?

A. domain: $x \in \mathbb{R}$
   range: $y \le -4$

B. domain: $x \in \mathbb{R}$
   range: $y \le 4$

C. domain: $x \le 6$
   range: $y \ge 4$

D. domain: $x \in \mathbb{R}$
   range: $y \in \mathbb{R}$

21. *The graph of $y = f(x)$ is stretched vertically by a factor of 6. What is the equation of the image graph in terms of the function f?

A. $y = 6f(x)$

B. $y = \frac{1}{6}f(x)$

C. $y = f(6x)$

D. $y = f(\frac{1}{6}x)$

22. *The point A $(16, 64)$ lies on the graph of $y = \sqrt{x^3}$. What are the coordinates of its image A' on the graph of $y = \frac{1}{4}\sqrt{(2x)^3}$?

A. $(8, 16)$ B. $(8, 32)$ C. $(4, 16)$ D. Not enough information is given.

23. *The graph of $y = f(x)$ is horizontally compressed by a factor of $\frac{1}{3}$, vertically compressed by a factor of $\frac{1}{2}$, and reflected in the y-axis. What is an equation of the image graph in terms of the function f?

A. $y = \frac{1}{2}f(-3x)$ B. $y - 3 = f(x - \frac{1}{2})$ C. $y - \frac{1}{2} = f(x - 3)$ D. $y = -3f(\frac{1}{2}x)$

24. *Which statement below describes how the graph of $y = f(x)$ has been transformed to get the graph of $y = f(-\frac{1}{3}(x - 2))$? It is the image of the graph of $y = f(x)$ after:

A. a vertical compression by a factor of $\frac{1}{3}$, a reflection in both axes, and a translation of 2 units right.

B. a vertical stretch by a factor of 3, a reflection in the y-axis, and a translation of 2 units down.

C. a horizontal stretch by a factor of 3, a reflection in the y-axis, and a translation of 2 units right.

D. a horizontal compression by a factor of $\frac{1}{3}$, a reflection in the y-axis, and a translation of 2 units right.

25. *Determine an equation of the inverse of the function $y = -6x - 5$.

A. $y = \frac{x - 6}{-5}$ B. $y = \frac{x - 5}{-6}$ C. $y = -6x + 5$ D. $y = \frac{x + 5}{-6}$

26. *Given $f(x) = x - 1$ and $g(x) = 3x^2 + 2$, what is an explicit equation for $p(x) = f(x) \cdot g(x)$?

A. $p(x) = 4x^3 + 3x^2 + 2x - 2$ C. $p(x) = 3x^2 - x - 2$

B. $p(x) = 3x^2 + x + 1$ D. $p(x) = 3x^3 - 3x^2 + 2x - 2$

27. *Given $f(x) = x + 2$ and $g(x) = x^2 - 25$, what is the domain of $q(x) = \frac{f(x)}{g(x)}$?

A. $x \neq 25$ B. $x \neq 5, x \neq -5$ C. $x \neq -2$ D. $x \in \mathbb{R}$

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28. *Here is the graph of $y = f(x)$. What are the domain and range of its inverse?

A. Domain:
$-5 \leq x \leq 4$
Range:
$-5 \leq y \leq -3$

B. Domain:
$3 \leq x \leq 5$
Range:
$-5 \leq y \leq 4$

C. Domain:
$-5 \leq x \leq 4$
Range: $3 \leq y \leq 5$

D. Domain:
$3 \leq x \leq 5$
Range:
$-4 \leq y \leq 5$

29. *Given the graphs of $y = f(x)$ and $y = g(x)$, what is the value of $f\big(g(3)\big)$?
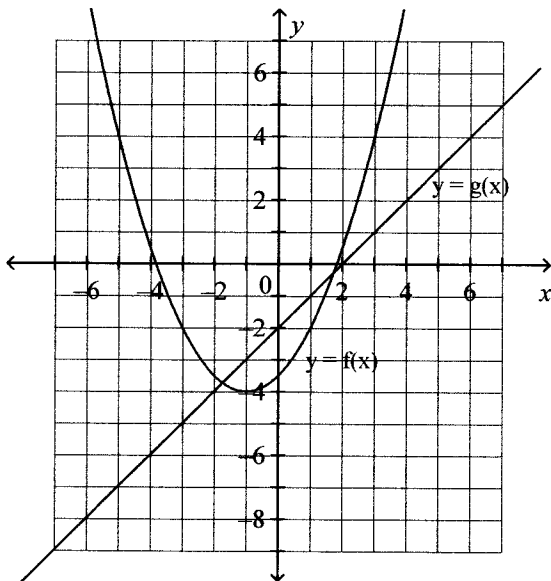
A. 4   **B.** −2   **C.** 2   **D.** −4

30. *Given $f(x) = \sqrt{4-x}$ and $g(x) = 3 - 5x$, what is an explicit equation for $f\big(g(x)\big)$?

A. $f\big(g(x)\big) = 3 - \sqrt{4 - 5x}$

B. $f\big(g(x)\big) = 1 - \sqrt{4 - 5x}$

C. $f\big(g(x)\big) = \sqrt{1 - 5x}$

D. $f\big(g(x)\big) = \sqrt{5x + 1}$

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31. *Use these tables. What is the value of $f\big(f(0)\big)$?

x	$f(x)$
−3	18
−2	11
−1	6
0	3
1	2
2	3
3	6

A. −2   **B.** 6   **C.** 2   **D.** 0

32. *Given $f(x) = \sqrt{2-x}$ and $g(x) = x^2 + 6x - 3$, which is an explicit equation for the composite function $h(x) = g\big(f(x)\big)$, and what is its domain?

A. $h(x) = \sqrt{-x^2 - 6x + 5}$
$x \geq 0$

C. $h(x) = \sqrt{-1 - x}$
$x \leq -1$

B. $h(x) = -1 - x$
$x \in \mathbb{R}$

D. $h(x) = -1 - x + 6\sqrt{2-x}$
$x \leq 2$

33. *Which exponential function is increasing?

A. $y = \left(\dfrac{1}{4}\right)^x$ **B.** $y = \left(\dfrac{4}{3}\right)^x$ **C.** $y = 0.1^x$ **D.** $y = 0.137^x$

34. *What is the y-intercept of the graph of $y = 4^{-4x} + 3$?

A. 1   **B.** 3   **C.** 259   **D.** 4

35. *Solve: $2^{x+1} = 16$

A. $x = 3$ **B.** $x = \dfrac{15}{2}$ **C.** $x = -3$ **D.** $x = 15$

36. *Solve: $125^{-2x} = 25^{x-24}$

A. $x = 6$ **B.** $x = 8$ **C.** $x = \dfrac{25}{3}$ **D.** $x = 3$

37. *Evaluate $\log_2 64$.

A. −6   **B.** 6   **C.** 32   **D.** 62

38. *Write this exponential expression as a logarithmic expression: $3^{\frac{2}{3}} = \sqrt[3]{9}$

A. $\frac{2}{3} = \log_3\left(\sqrt[3]{9}\right)$ **C.** $\frac{2}{3} = \log_{\sqrt[3]{9}}(3)$

B. $3 = \log_{\frac{2}{3}}\left(\sqrt[3]{9}\right)$ **D.** $\log_3\left(\frac{2}{3}\right) = \sqrt[3]{9}$

39. *Which of these expressions is NOT equal to $\log 160$?

A. $\log 80 + \log 2$ **C.** $\log 16 + \log 10$
B. $\log 48 + \log 112$ **D.** $\log 8 + \log 20$

40. *The graph of $y + 4 = \log_6(x + 8)$ is the image of the graph of $y = \log_6 x$ after it has been

A. translated 8 units left and 4 units up.
B. translated 8 units right and 4 units down.
C. translated 8 units left and 4 units down.
D. translated 8 units right and 4 units up.

41. *Which logarithm is equal to $\log_5(x + 6) + \log_5 x$?

A. $\log_5(8x)$ **C.** $\log_5(2x + 6)$
B. $\log_{10}\left(x^2 + 6x\right)$ **D.** $\log_5\left(x^2 + 6x\right)$

42. *Solve: $3\log 9 = \log x$

A. $x = \frac{1}{3}$ **B.** $x = 12$ **C.** $x = 729$ **D.** $x = 27$

43. *What is the solution of the equation $6\left(5^{x+3}\right) = 4500$?

A. $x = \dfrac{\log 6}{\log 5}$ **C.** $x = \dfrac{\log 750}{\log 5}$

B. $x = \dfrac{\log 4500}{\log 30}$ **D.** $x = \log 250$

44. *An account pays 5.0% annual interest, compounded semi-annually (twice a year). What is the interest rate per compounding period, as a decimal?

A. 5.0   **B.** 0.025   **C.** 0.05   **D.** 2.5

45. What is the value of $\sin(-256°)$ to the nearest thousandth?

A. 0.970   **B.** −0.242   **C.** −0.970   **D.** 1.031

46. *What is the measure of the reference angle for an angle of $-546°$ in standard position?

    A. $6°$ B. $-6°$ C. $-186°$ D. $84°$

47. *What is the length of the arc that subtends a central angle of $80°$ in the unit circle?

    A. $\frac{2}{9}\pi$ units   B. $\frac{9}{4}\pi$ units   C. 40π units   D. $\frac{4}{9}\pi$ units
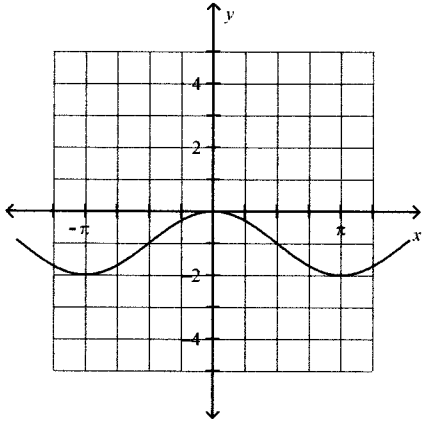
48. *What is $-120°$ in radians?

    A. $-\frac{2}{3}\pi$ radians   B. $\frac{-21\,600}{\pi}$ radians   C. -120π radians   D. $-\frac{2}{3}$ radians

49. *What is the amplitude of the function $y = 7\sin x$?

    A. -7 B. 7 C. 14 D. 7π

50. *Which function below describes this graph?

    A. $y = 2\cos x$ B. $y = \cos x$ C. $y = \cos x - 1$ D. $y = \cos x - 2$

51. *What is the period of the function $y = 7\cos 9\left(x + \frac{\pi}{7}\right) + 2$?

    A. $\frac{2\pi}{9}$ B. $\frac{\pi}{7}$ C. 7π D. $\frac{9\pi}{2}$

52. *What is the period of the function $y = 5\sin \frac{3\pi}{5}(x + 1) + 8$?

    A. $\frac{13}{3}$ B. $\frac{3}{10}$ C. $\frac{10}{3}$ D. 2

53. What are the solutions of the equation $\tan x = -\frac{1}{2}$ for $0 \leq x \leq 2\pi$, to the nearest hundredth?

    A. $x \doteq 1.11$ or $x \doteq 2.68$ C. $x \doteq 2.68$ or $x \doteq 5.82$
    B. $x \doteq 153.43$ D. $x \doteq -0.55$

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54. *Identify the transformations that would be applied to the graph of $y = \cos x$ to get the graph of $y = 7\cos\left(x - \dfrac{\pi}{2}\right)$.

   A. A vertical stretch by a factor of 7, and then a translation of $\dfrac{\pi}{2}$ units left

   B. A vertical stretch by a factor of $\dfrac{\pi}{2}$, and then a translation of 7 units right

   C. A vertical stretch by a factor of 7, and then a translation of $\dfrac{\pi}{2}$ units right

   D. A horizontal stretch by a factor of 7, and then a translation of $\dfrac{\pi}{2}$ units right

55. What are the solutions of the equation $\cos 2x = -\dfrac{1}{4}$ for $0 \le x \le \pi$, to the nearest hundredth?

   A. $x \doteq 0.91$ or $x \doteq 2.23$ **C.** $x \doteq 52.24$
   B. $x \doteq 0.91$ or $x \doteq 2.48$ **D.** $x \doteq 1.82$ or $x \doteq 4.46$

56. What are the roots of the equation $2\tan x + 1 = 0$ for $-180° \le x \le 180°$, to the nearest degree?

   A. $x \doteq 3°$ **C.** $x \doteq -27°$ or $x \doteq 63°$
   B. $x \doteq -27°$ or $x \doteq 153°$ **D.** $x \doteq -0°$

57. *Write the expression $\dfrac{\csc\theta \cot\theta \sin\theta}{\cos\theta}$ as a single term.

   A. $\cot\theta$ **B.** $\csc\theta$ **C.** $\cos\theta$ **D.** $\sec\theta$

58. *Write the expression $\sec\theta\left(\sin^2\theta - 1\right)$ as a single term.

   A. $\cos\theta$ **B.** $-\cos^2\theta$ **C.** $-\cos\theta$ **D.** $\sec^2\theta$

59. *Write the expression $\sin 5\theta\cos 2\theta + \cos 5\theta\sin 2\theta$ as a single term.

   A. $\sin 3\theta$ **B.** $\sin 7\theta$ **C.** $\cos 3\theta$ **D.** $\cos 7\theta$

60. *What is the exact value of the expression $\sin 40°\cos 95° + \cos 40°\sin 95°$?

   A. -1 **B.** 1 **C.** $-\dfrac{1}{\sqrt{2}}$ **D.** $\dfrac{1}{\sqrt{2}}$

61. *Write the expression $2\sin 4\theta\cos 4\theta$ as a single term.

   A. $\cos 8\theta$ **B.** $\sin 10\theta$ **C.** $\cos 10\theta$ **D.** $\sin 8\theta$

62. *At a school cafeteria, a meal consists of a main dish, a side dish, and a dessert. There are 3 main dishes, 4 side dishes, and 7 desserts to choose from. How many different meals are possible?

   **A.** 36   **B.** 84   **C.** 45   **D.** 14

63. *A video game allows a player to customize the appearance of her avitar. There are 5 hair colours, 6 hairstyles, 3 faces, and 8 outfits to choose from. How many different avitars can be created?

    A. 720   **B.** 22   **C.** 264   **D.** 280

64. *A security code consists of 3 letters followed by 1 digit. The first letter in the code must be a vowel. How many different security codes are possible?

    A. 33 800   **B.** 175 760   **C.** 141 960   **D.** 3390

65. *Which expression cannot be evaluated?

    A. $_8P_6$ **B.** $_{10}P_0$ **C.** $_9P_9$ **D.** $_{12}P_{14}$

66. *How many 2-letter permutations are there for the word LEARN?

    A. 120   **B.** 20   **C.** 6   **D.** 118

67. *What is the value of $\dfrac{11!}{6!5!}$?

    A. $\dfrac{11}{30}$ **B.** 1 663 200   **C.** 39 916 800   **D.** 462

68. *Which of these numbers has the least number of permutations of all its digits?

    A. 445 869   **B.** 859 647   **C.** 444 444   **D.** 444 484

69. *A student has 12 different books on her bookshelf. She wants to take 6 of them with her on a train trip. How many selections of 6 books could she make?

    A. 665 280   **B.** 720   **C.** 924   **D.** 72

70. *Which expression is *not* equivalent to $_3C_2$?

    A. $\dfrac{3!}{2!\,(3-2)!}$ **B.** $\dfrac{_3P_2}{2!}$ **C.** $_3C_1$ **D.** $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$

71. *What is the value of the 6th number in row 11 of Pascal's triangle?

    A. $_{10}C_5$ **B.** $_{12}C_7$ **C.** $_{11}C_6$ **D.** $_5C_{10}$

72. *What are the first three terms in the expansion of $(x+8)^{11}$?

    A. $x^{11} + 8x^{10} + 64x^9$ **C.** $x^{11} + 88x^{10} + 3520x^9$
    B. $x^{11} + 11x^{10} + 55x^9$ **D.** $x^{11} + 80x^{10} + 2880x^9$

Problem

1. For what values of k does the equation $125^x = 25^{(x^2+k)}$ have no real solution?

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2. Sketch the graph of $y = 4\cos 2\left(x - \dfrac{\pi}{4}\right) + 1$.

   Describe these characteristics of the function: amplitude, period, phase shift, equation of the centre line, domain, and range
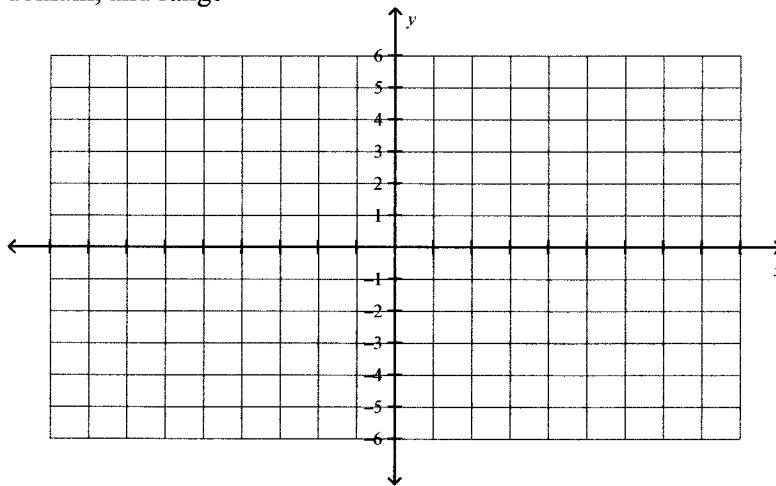
3. Prove the identity $\sin^2\theta = 1 + \cot^2\theta\cos^2\theta - \cot^2\theta$.

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4. Expand $\left(\dfrac{1}{4}x + \dfrac{2}{5}y\right)^5$.