Math 1320, Final Exam, 12/11/17, Version A [1]

Directions: Turn off all cellphones, electronic music devices, etc. Basic function calculators *are permitted*, but calculators with graphing or algebraic functionality are not allowed. This exam has 21 multiple choice questions worth 1 point each and two short answer questions worth 2 points each. Be sure to answer all 23 questions!

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1. (1 point) Write the expression $5\sqrt{-8}+\sqrt{-50}$ in standard form.
(A) $5i\sqrt{2}$ **(B)** $-10i\sqrt{2}$ **(C)** $-15i\sqrt{2}$ **(D)** $2i\sqrt{5}$ **(E)** $15i\sqrt{2}$

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2. (1 point) Write the standard form of the equation of a circle with center (2,-3) and radius 4.
(A) $(x-2)^2+(y+3)^2=4$ **(B)** $(x+2)^2+(y-3)^2=16$ **(C)** $(x-2)^2+(y+3)^2=16$
(D) $(x-2)^2-(y+3)^2=16$ **(E)** $(x-2)^2+(y-3)^2=4$

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3. (1 point) Solve the exponential equation $3^{3x+2}=9^{2x}$.
(A) -2 **(B)** 2 **(C)** -1 **(D)** $\ln 3$ **(E)** $\log_3 2$

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4. (1 point) After a 30% reduction, you purchase a dictionary for \$30.80. What was the dictionary's price before the reduction?
(A) \$40 **(B)** \$42 **(C)** \$44 **(D)** \$46 **(E)** \$41

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5. (1 point) Find the inverse function of $f(x)=x^2-4$.
(A) $f^{-1}(x)=\sqrt{x-4}$ **(B)** $f^{-1}(x)=\sqrt{x+4}$ **(C)** $f^{-1}(x)=\sqrt{x}-4$
(D) $f^{-1}(x)=\sqrt{x}+4$ **(E)** $f^{-1}(x)=2-\sqrt{x}$

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6. (1 point) Evaluate $\ln\left(\frac{e^4}{8}\right)$.
(A) $8+\ln 4$ **(B)** $8-\ln 4$ **(C)** $4+\ln 8$ **(D)** $4-\ln 8$ **(E)** $4\ln 8$

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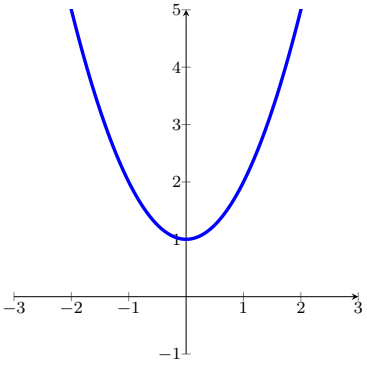
7. (1 point) Which function has the graph given below?



(A) $f(x)=x^2+1$ **(B)** $f(x)=x^3-1$ **(C)** $f(x)=2x^2+x$ **(D)** $f(x)=x$
(E) $f(x)=-3x^2+1$

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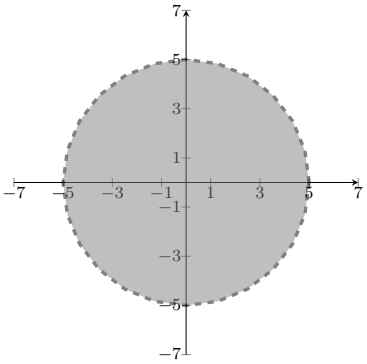
8. (1 point) Which inequality describes the shaded area in the following figure?



(A) $x^2 + y^2 = 25$ **(B)** $x^2 + y^2 < 25$ **(C)** $x^2 + y^2 \leq 25$ **(D)** $x^2 + y^2 \geq 25$
(E) $x^2 + y^2 > 25$

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9. (1 point) Solve the following equation: $\dfrac{1}{x} + \dfrac{1}{x+5} = \dfrac{1}{4}$.

(A) $x = \dfrac{3 \pm \sqrt{89}}{2}$ **(B)** $x = \dfrac{5 \pm \sqrt{19}}{2}$ **(C)** $x = -4/5$ **(D)** $x = 1$ **(E)** $x = \dfrac{-4 \pm \sqrt{5}}{2}$

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10. (1 point) Find the vertex of the parabola defined by $y = -3x^2 + 6x - 1$.

(A) $(-2, 1)$ **(B)** $(0, -1)$ **(C)** $(-1, -10)$ **(D)** $(1/3, -2/9)$ **(E)** $(1, 2)$

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11. (1 point) Suppose that the population (in millions) of country A is modeled by the function $A = 133e^{.05t}$, where t is the number of years after 2011. During which year will the population of country A reach 147 million?

(A) 2011 **(B)** 2012 **(C)** 2013 **(D)** 2014 **(E)** 2015

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12. (1 point) Find all zeros of $f(x) = x^3 + 2x^2 - 5x - 6$.

(A) $\{4, 1, 1\}$ **(B)** $\{-1, 5, 2\}$ **(C)** $\{2, 0, -1\}$ **(D)** $\{-3, -1, 2\}$ **(E)** $\{3, 4, 3\}$

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13. (1 point) Solve by substitution

$$\begin{cases} x - y &= 3, \\ (y+3)^2 &= 4 - (x-2)^2. \end{cases}$$

(A) $\{(0, -3), (2, -1)\}$ **(B)** $\{(4, 3), (-1, 4)\}$ **(C)** $\{(2, -3), (0, -1)\}$ **(D)** $\{(-2, 4), (1, 3)\}$
(E) No solution

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14. (1 point) A sum of \$100,000 is invested into an account paying 9% annual interest compounded quarterly. Find the balance in the account after 8 years.

(A) $A = 100000\,(1 + 0.09)^{45}$ **(B)** $A = 100000\left(1 + \dfrac{0.09}{4}\right)^{32}$ **(C)** $A = 100000\left(1 + \dfrac{0.09}{5}\right)^{40}$
(D) $A = 100000\left(1 + \dfrac{0.09}{9}\right)^{16}$ **(E)** $A = 100000\left(1 + \dfrac{0.09}{8}\right)^{8}$

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15. (1 point) Solve the inequality $|3(x+1) + 9| \leq 12$.

(A) $[-8, 12)$ **(B)** $[-12, 0]$ **(C)** $(0, 8)$ **(D)** $[-7, -1]$ **(E)** $[-8, 0]$

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16. (1 point) Solve the following system of linear equations:

$$\begin{cases} x + z = 3 \\ x + 2y - z = 1 \\ 2x - y + z = 3. \end{cases}$$

(A) $\{(1, 0, -3)\}$ **(B)** $\{(-2, 1, 3)\}$ **(C)** $\{(1, 1, 2)\}$ **(D)** $\{(0, 1, 5)\}$ **(E)** $\{(2, 0, -1)\}$

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17. (1 point) Let $f(x) = \dfrac{4}{x+2}$ and $g(x) = \dfrac{1}{x}$. Which of the following is TRUE?

(A) the domain of $f \circ g$ is $(-\infty, 0) \cup (0, \infty)$, **(B)** $(f \circ g)\left(\frac{1}{2}\right) = 2$,
(C) the domain of $g \circ f$ is $(-\infty, \infty)$, **(D)** $(g \circ f)(2) = 1$,
(E) $(f \circ g)(1) = (g \circ f)(1)$.

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18. (1 point) Find an equation for the line passing through the point $(2, 5)$ which is parallel to the line given by $6x + 2y = 4$.

(A) $y - x = 11$ **(B)** $2y - 3x = 5$ **(C)** $y + 3x = 11$ **(D)** $5y + 4x = 12$
(E) $-2y + x = 6$

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19. (1 point) The number of gallons of water, W, used when taking a shower varies directly as the time, t, in minutes in the shower. A shower lasting 7 minutes uses 42 gallons of water. How much water is used in a shower lasting 15 minutes?

(A) 20 gallons **(B)** 30 gallons **(C)** 60 gallons **(D)** 90 gallons
(E) 120 gallons

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20. (1 point) Solve $2x - 3x^{1/2} + 1 = 0$.

(A) $\left\{\frac{1}{4}, 1\right\}$ **(B)** $\left\{\frac{-1}{4}, 1\right\}$ **(C)** $\left\{\frac{1}{4}, -1\right\}$ **(D)** $\left\{\frac{-1}{4}, -1\right\}$ **(E)** $\left\{\frac{-1}{4}, \frac{1}{4}\right\}$

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21. (1 point) Find the domain of the function $f(x) = \sqrt{13 - x}$.

(A) $(-\infty, 13) \cup (13, \infty)$ **(B)** $[13, \infty)$ **(C)** $(-\infty, \infty)$ **(D)** $(-\infty, 13]$
(E) $(-13, 13)$

Short answer problems:

Give careful, detailed solutions in your bluebook. Be sure to show all your work and explain your reasoning.

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22. (2 points) The formula for converting Fahrenheit temperature F to Celsius temperature C is

$$C = \frac{5}{9}(F - 32).$$

If Celsius temperature ranges from $15°$ to $35°$ inclusive, what is the range for the Fahrenheit temperature? Express your answer using interval notation.

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23. (2 points) Use mathematical induction to prove that, for every positive integer n,

$$1 + 3 + 5 + \cdots + (2n - 1) = n^2.$$