

GENERAL INSTRUCTIONS: Read all instructions carefully.

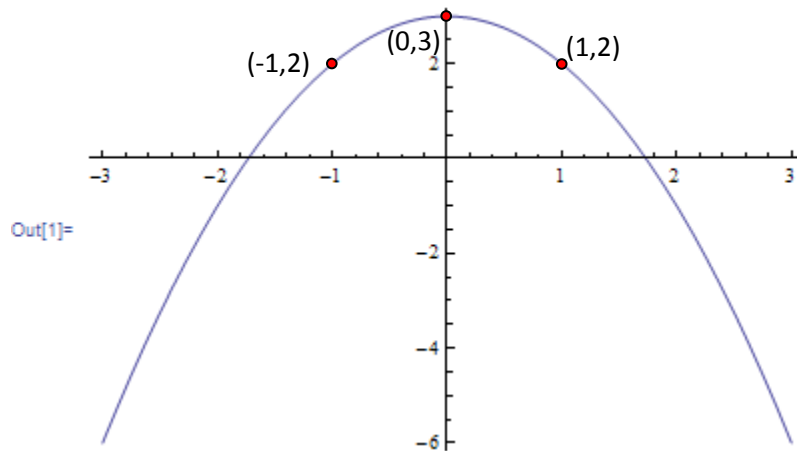
1. You have 55 minutes to complete the Fundamental Concepts Exam (FCE).
2. This exam evaluates the understanding of the math concepts fundamental to each cadet at this stage of his/her academic development. This is a non-technology exam. No references of any kind may be used.
3. Including this cover page, there are eight pages to the exam.
4. Place your name on every exam page.
5. Show as much work as possible to maximize credit. **Unless the question states "simplify," you do not need to simplify your answers.**
6. Clearly indicate your answer (e.g. $0 < x < 5$, or $\boxed{0 < x < 5}$).
7. Should you require additional space, use a blank sheet of paper and clearly identify that the problem is continued on both the exam and on the continuation sheet. Be sure to put your name on any extra pages you use.
8. Early departure is authorized. Make sure you comply with exam turn-in requirements as outlined by your instructor.

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1. Write 582.4 in scientific notation. *ANS: 5.824×10^2*
2. Expand the product $(2 - x)(-4 - x)$. *ANS: $x^2 + 2x - 8$*
3. Given that $f(x) = \cos x$, write the function that shifts $f(x)$ to the left by 2 units.
ANS: $f(x + 2) = \cos(x + 2)$
4. Solve for the roots of $g(x) = x^2 + 7x + 10$. *ANS: $x = -2, -5$*
5. Solve $x^2 + 5x - 3 < 2x + 1$ for x . *ANS: $\{x \mid -4 < x < 1\}$*
6. Find the equation of the line that passes through the point $(-3, 0)$ and that is perpendicular to the line $y = \frac{1}{5}x - 3$. *ANS: $y = -5(x + 3)$ or $y = -5x - 15$*
7. Evaluate $j(x) = \sqrt{5 - x^2}$ at $x = a$. *ANS: $j(a) = \sqrt{5 - a^2}$*
8. What is the domain of the function $m(\theta) = \cos(\theta + \pi)$? *ANS: Domain: $\{\theta \mid \theta \in \mathbb{R}\}$*
9. Completely simplify $\log_a 4 - \log_a 2$. *ANS: $\log_a 2$*

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10. Sketch a graph of $y = 3 - x^2$. Label three points on your sketch.



11. How long is the diagonal of a 2" \times 4" rectangle? *ANS: $\sqrt{20}$ inches = $2\sqrt{5}$ inches*
12. If Nancy runs the first mile of the APFT in 6 minutes 45 seconds, and she wants to finish the 2-mile course in under 14 minutes 15 seconds, at what speed must she run the remaining mile? *ANS: $\frac{1}{7.5} \approx .13$ miles/minutes = $\frac{60}{7.5} \approx 8$ miles/hour*
13. Write $x^{\frac{5}{3}}$ using radical notation. *ANS: $\sqrt[3]{x^5}$*
14. Write 45 as a *product* of its prime factors. *ANS: $45 = 3 * 3 * 5$*
15. Solve $|x + 3| = 2$ for x . *ANS: $x = -5, -1$*
16. Find the equation of the line that passes through the points (3,4) and (5,4).
ANS: $y = 4$
17. What is the range of the function $h(x) = -x^4$? *ANS: Range: $\{h(x) | h(x) < 0\}$*

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18. Solve $\begin{cases} y = 3x + 4 \\ y^2 = 9x^2 + 4 \end{cases}$ for x and y . *ANS: $x = -\frac{1}{2}, y = \frac{5}{2}$*

19. If the hypotenuse of a 30-60-90 right triangle measures 8 inches, how long is the side of the triangle that is adjacent to the 60° angle? *ANS: 4 inches*

20. Solve $2 = \log_4 x$ for x . *ANS: $x = 4^2 = 16$*