
FCE Sample 10– MA103

GENERAL INSTRUCTIONS: Read all instructions carefully.

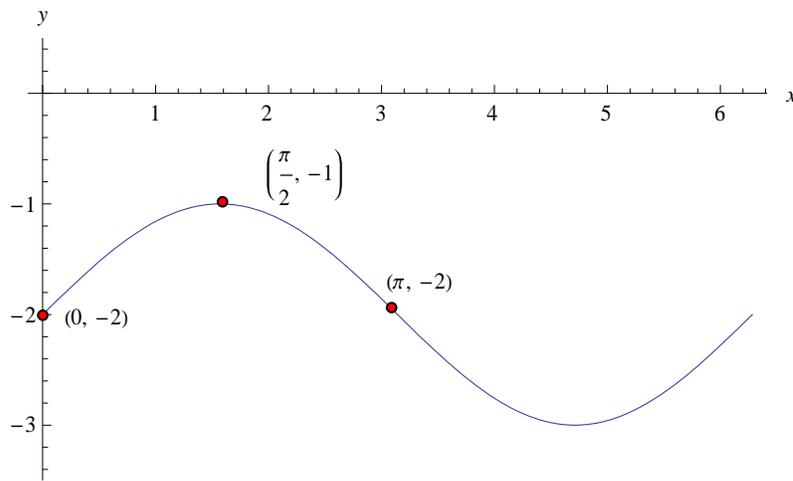
1. You have 55 minutes to complete the Fundamental Concepts Exam (FCE).
2. This exam evaluates the understanding of the math concepts fundamental to each cadet at this stage of his/her academic development. This is a non-technology exam. No references of any kind may be used.
3. Including this cover 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. Completely simplify $\frac{1}{\frac{1}{4}\left(1-\frac{3}{4}\right)} = \frac{1}{\frac{1}{4} \cdot \frac{1}{4}} = 16$
2. Solve $5^x = \frac{1}{25}$ for x . $x = \log_5(5^{-2}) = -2$
3. Expand the product $(2x + 4)(1 - 3x)$ and combine like terms. $4 - 10x - 6x^2$
4. Find all roots of $x^2 - 10x + 23 = 0$. $\text{ANS: } x = \frac{10 \pm \sqrt{100 - 4(23)}}{2} = \frac{10 \pm 2\sqrt{2}}{2} = 5 \pm \sqrt{2}$
5. Find the distance between the points $(-1, -2)$ and $(3, 5)$. $\text{ANS: } d = \sqrt{(3 - (-1))^2 + (5 - (-2))^2} = \sqrt{16 + 49} = \sqrt{65}$
6. Solve $x^2 + 3x \leq 4$ for x . $\text{ANS: } -4 \leq x \leq 1$
7. Find an equation of the line that passes through the points $(-1, 2)$ and $(-3, 4)$.
 $\text{ANS: } (y - 4) = -(x + 3)$
8. If the independent variable of $w(\theta) = 2\theta^2$ is restricted to values in the interval $[2, 5]$, what is the interval of all possible values of the dependent variable? $\text{ANS: } [8, 50]$
9. Completely simplify $2 \cot x \sec x \sin x$. $\text{ANS: } 2$
10. Completely simplify $\left(\frac{3a^{-2}}{b}\right)^{-2}$. $\text{ANS: } \left(\frac{a^4 b^2}{9}\right)$
11. Solve $\begin{cases} 2x = 1 - 7y \\ y = x + 4 \end{cases}$ for x and y . $\text{ANS: } x = -3, y = 1$
12. Given $g(t) = 1 + 5t$ and $h(s) = 3s^2$, evaluate $g(3) - h(-1)$. $\text{ANS: } 13$

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13. Graph $y = \sin(x) - 2$ on the domain $[0, 2\pi]$. Label three points on the graph.



14. If you double the length of the sides of a cube, by how much is the volume affected?

ANS: $V_1 = s^3$; $V_2 = (2s)^3 = 8s^3$, therefore volume is increased by a factor of eight.

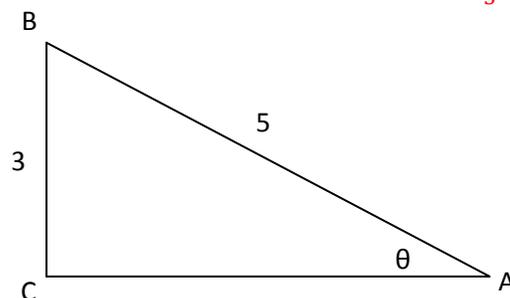
15. Completely simplify $(\log_4 8 + \log_4 2)$. ANS: 2

16. Find an equation of the line that is parallel to the line $6x + 3y = 12$ and passes through the point $(2, 3)$. ANS: $(y - 3) = -2(x - 2)$

17. Solve $x^2 + 7x + 12 = 0$ for x . ANS: $x = -3, -4$

18. Completely simplify $(\sqrt{xy^3})^6$. Write your answer without using radicals. ANS: x^3y^9

19. Given the right triangle below, what is $\cos(\theta)$? ANS: $\frac{4}{5}$



20. Solve $5 + x > -(x + 31)$ for x . ANS: $x > -18$