Cadet _____   Section_____

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FCE 7

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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 (numbered one through eight) 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. Be sure to clearly indicate your answer!

7. Should you require additional space, use a blank sheet of paper and clearly identify that the
    problem is continued both on 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. Simplify the following expression using trigonometric identities in terms of sine and cosine.

$$\frac{(\cot x)(\cos x)}{(1-\sin^2 x)} * \frac{1}{\csc x} = 1$$

2. Given the following right triangle, what is the length of z ?
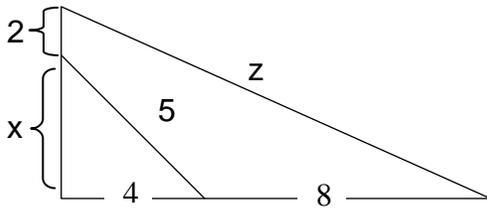
z=13

3. Simplify the following expression: $\log_2(3) + \log_2(5)$.

$$\log_2(3) + \log_2(5) = \log_2(15)$$

4. Given $y = \log_e x$, what is the value for x when $y = 0$?

$x=1$

5. The PT test is coming up and you need to come up with a workout plan to ensure you score above a 290 on the APFT. You determine that your weakest event is the run so you wish to spend 40% of your training time running. Knowing you perform equally well on sit-ups and push-ups, you determine you should spend 15% of your time on each. The remaining 90 minutes you'll spend cross-training. How much time will you workout each week?

5 hours or 300 minutes

6. Where does the graph of the function $f(x) = 2x^2 - 4x + 1$ cross the x axis?

$$1 \pm \frac{1}{2}\sqrt{2} \ or \ 1 \pm \frac{\sqrt{8}}{4} \ or \ \frac{4 \pm \sqrt{8}}{4}$$

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7. Simplify $\dfrac{8x^3 y^8}{32xy^9}$.

$\dfrac{x^2}{4y}$

8. Find the point where the following lines intersect $\begin{cases} 2x + y = 5 \\ x + 2y = -8 \end{cases}$.

(6, -7)

9. Given $p(y) = 3y^2 - y + 6$, $z(x) = 2x$; find $p(z(5))$.

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10. If you double the height of a triangle, what happens to its area?

It doubles.

11. Solve the following equation for y: $\dfrac{2}{3+y} = \dfrac{x}{5}$.

$\dfrac{10 - 3x}{x} = y$

12. Solve for **all** values of x that satisfy: $-5 = x^2 - 2x - 29$.

$x = $ -4, 6

13. If $|2 - 4x| < 3$, solve for x.

-1/4 $< x <$ 5/4

14. What is the range of $f(x) = Cos(2x) - 1$?

Range: -2 $\leq f(x) \leq 0$

15. What is the straight line distance between (3, -2) and (6, 1)?
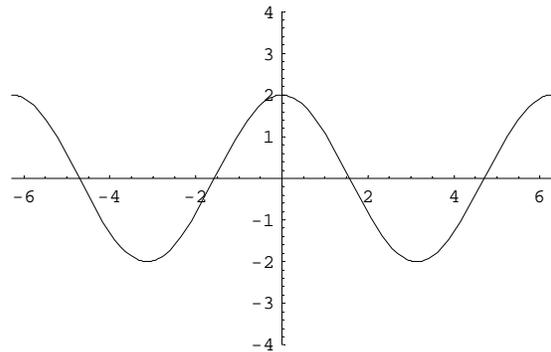
$\sqrt{18}$

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16. What is a function describing this graph?

   a. $f(x) = 2\cos(x)$

   b. $f(x) = \cos(2x)$

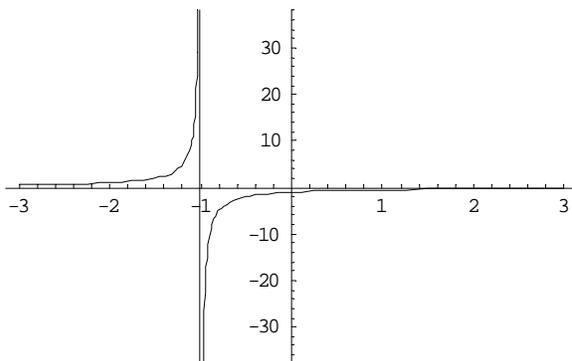   c. $f(x) = \cos(x) + 2$

   d. $f(x) = \cos(x + 2)$

17. What is the domain of the real valued function $y = \ln(2x)$?

   Domain: $x > 0$

18. On a 55-mile car trip to New York, NY, you drive the first twenty miles at 40 miles per hour. How fast will you have to go the last thirty-five miles in order to arrive exactly one hour after you left?

   70 mph

19. Sketch the graph of the function $h(t) = \dfrac{-1}{t+1}$. Identify three points on your graph of $h(t)$.

20. Find the equation of the line perpendicular to the line $2y = 4x + 6$ and through the point $(-1, 4)$.

   $y = -\dfrac{1}{2}x + \dfrac{7}{2}$