

Sheet No. 1

Cadet \_\_\_\_\_ Section \_\_\_\_\_

FCE 6

---

GENERAL INSTRUCTIONS: Read all instructions carefully.

1. You have 55 minutes to complete the fundamental concepts exam (FCE).
2. Early departure is authorized. Give the FCE to your instructor when completed.
3. 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.
4. Including this cover page, there are five pages (numbered one through five) to the exam.
5. Show as much work as possible.
6. If you need more room, use a blank continuation sheet and clearly identify that the problem is continued both on the exam and on the continuation sheet. Be sure to put your name on the continuation sheet.
7. Place your name on every exam page.

**FOR MORE SPACE USE AN EXTRA SHEET**

1. There is a line through the points (5,1) and (2,-5). There is another line through the points (1,3) and (0,-1). Do the lines intersect? Why or why not?

***Yes, lines with different slopes must intersect.***

2. Solve for  $\frac{11}{\frac{x}{3} + 2} = 3$

**$x = 5$**

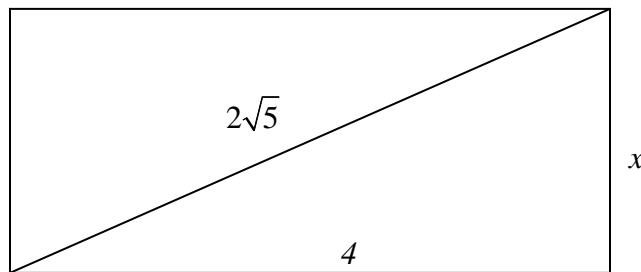
3. Given that  $f(x) = 3^x(4)$ , find x when  $f(x) = 20$

**$x = \log_3 5$**

4. Given the relation  $a = \frac{v^2}{r}$ , what happens to  $a$  if  $v$  increases while  $r$  stays the same?

***a increases proportionally as the square of v.***

5. Find x:



**$x = 2$**

6. The volume of a rectangular box with a base of 8 inches by 4 inches is 96 cubic inches. How tall is the box?

$$h = 3 \text{ inches}$$

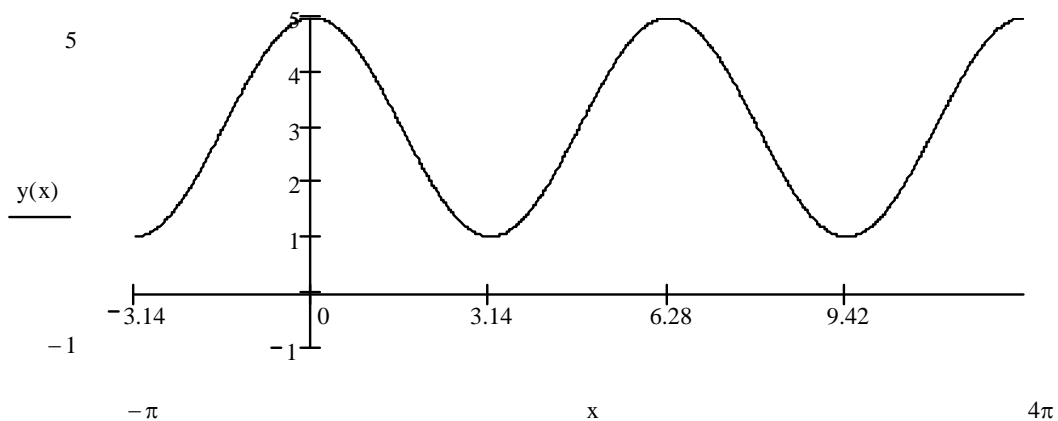
7. Simplify  $8^{\frac{1}{2}} \cdot 16^{\frac{3}{4}}$

$$2\sqrt{2}$$

8. On a 110-mile car trip to Princeton, NJ, you take the back roads and drive the first thirty miles at 40 miles per hour. Deciding to get onto the thruway, how fast will you have to go to complete the trip exactly two hours after you left?

$$64 \text{ mph}$$

9. What is an equation for the graph below?



$$y(x) = 2 \cos x + 3$$

10. Find the roots of the following polynomial:  $2x^2 - 4x - 3$

$$x = 1 \pm \frac{\sqrt{10}}{2}$$

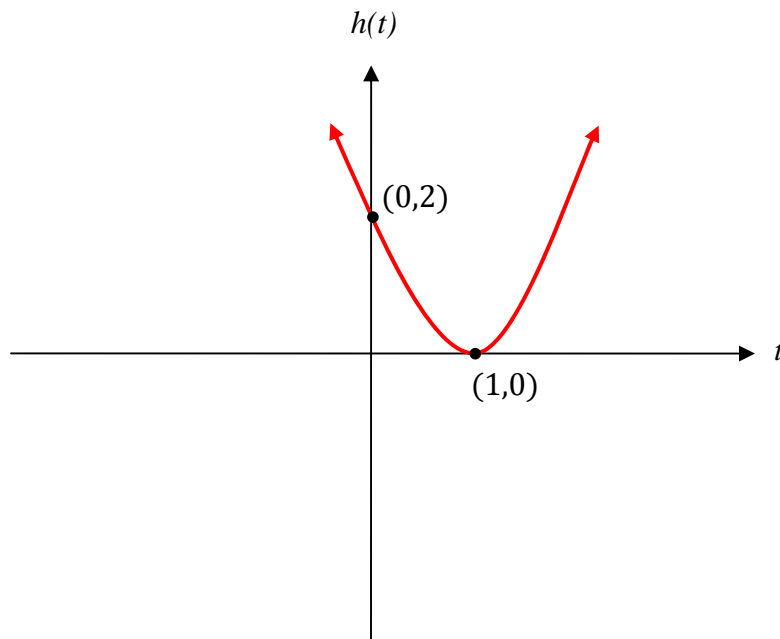
11. Find the equation of the line perpendicular to the line  $3y = 6x + 5$  passing through the point (2,1).

$$y - 1 = -\frac{1}{2}(x - 2)$$

12. Simplify the following expression:  $\frac{8x^4y^7}{32x^5y^4}$

$$\frac{y^3}{4x}$$

13. Sketch the graph of the function:  $h(t) = 2(t-1)^2$ . Identify two points on the graph.



14. Do the following lines intersect? If so, how many times and where?

Line 1:  $6y + 8x = 32$

Line 2:  $y - 2x = 8$

**Yes, once at  $\left(-\frac{4}{5}, \frac{32}{5}\right)$**

15. Solve for **all** values of  $x$  that satisfy:  $x^2 = (2x - 5)(x + 1) - x$ .

**$x = -1$  and  $5$**

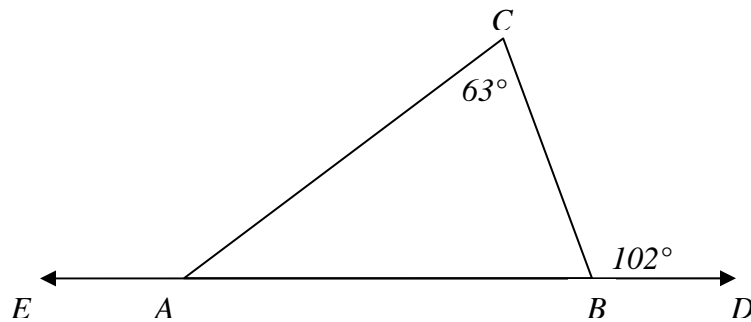
16. Solve  $1 + |2x| < 4$  for all values of  $x$ .

$$-\frac{3}{2} < x < \frac{3}{2}$$

17. Given  $g(t) = 6t - 2$  and  $h(s) = 5s^3$ , find  $g(a) + h(1)$ .

$$g(a) = h(1) = 6a + 3$$

18. In the diagram below, what is the angle  $EAC$ ?



$$\angle EAC = 141^\circ$$

19. What happens to the function  $f(x) = \frac{1}{4x+16}$  as  $x$  gets close to  $-4$ ?

*as  $x$  approaches  $-4$  from the left,  $f(x)$  approaches  $-\infty$ .  
as  $x$  approaches  $-4$  from the right,  $f(x)$  approaches  $+\infty$ .*

Sheet No. 7

Cadet \_\_\_\_\_ Section \_\_\_\_\_

FCE 6

20. Where does the graph of the function  $f(x) = x^2 + 3x - 18$  cross the  $x$ -axis?

***at  $x = -6$  and  $3$***

**FOR MORE SPACE USE AN EXTRA SHEET**