

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.

1. Find the equation of a line that passes through the points (-1,5) and (4,2).

$$y - 5 = -\frac{3}{5}(x + 1)$$

2. Solve for x: $\frac{12}{\frac{x}{3} + 2} = 5$

$$x = \frac{6}{5}$$

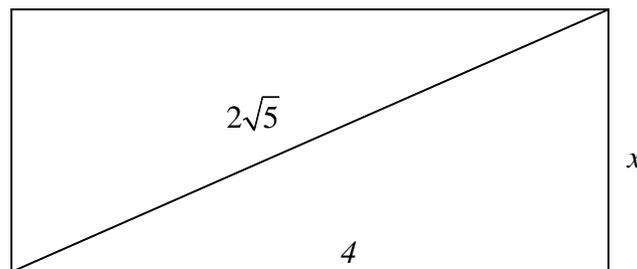
3. An angle measuring $\frac{3\pi}{8}$ radians is equivalent to how many degrees?

$$67.5^\circ$$

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

a increases proportionally to 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. Given that $y = \log_3 x$, find y when $x = 27$.

$$y = 3$$

8. Two patrols depart from the same point at the same time. One patrol travels north at 2 miles per hour and the other travels east. Assuming the patrols walk in a straight line and the distance between the patrols 2 hours later is 5 miles, how fast is the second patrol traveling?

$$1.5 \text{ mph}$$

9. What is the range of $f(x) = \sin\left(\frac{3}{2}x\right) + 1$?

$$\text{Range: } \{f(x) \mid 0 \leq f(x) \leq 2\}$$

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

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

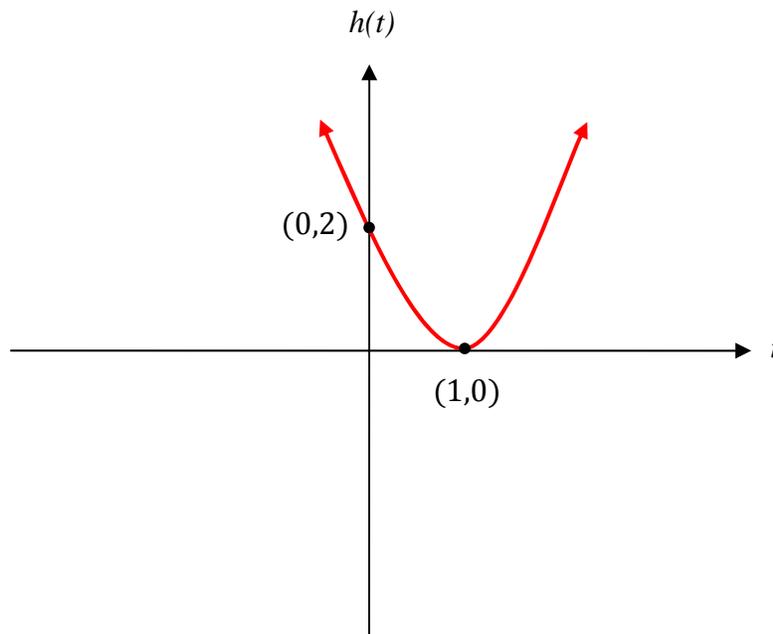
11. Find the equation of the line perpendicular to the line $3y = 9x + 6$ and through the point $(-2, 2)$.

$$y - 2 = -\frac{1}{3}(x + 2)$$

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

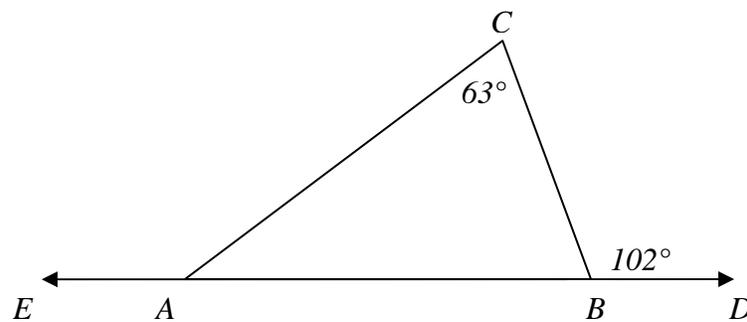
16. Solve $1 + |2x| < 4$ for all values of x .

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

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 $+\infty$.

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

$$x = -6 \text{ and } 3$$