ICM Final Exam Review

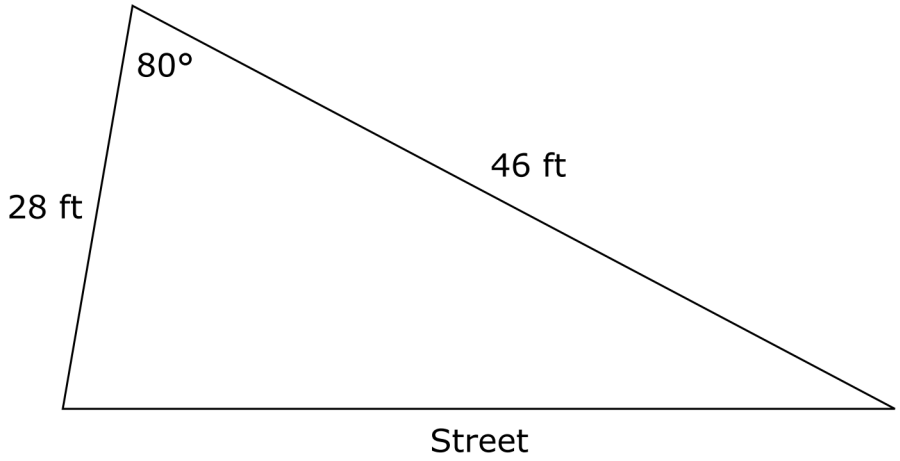
Name: _____ **Date:** _____

1) Given: $5x - 2y + z = 0$
$2x - y + z = -3$
$3x + 4y = 18$

What is the value of x in the solution of this system?

2) If $17^m = 6$, what is m?

3) Suppose that for each foot of land along the street, the annual tax is \$25 per foot. The diagram below shows a plot of land.



About how much is the annual tax for the plot?

4) Divide $(x^3 - 2x^2 + 6x - 8)$ by $(x - 2)$

5) $\dfrac{7z^2 + 7z}{4z + 8} \cdot \dfrac{z^2 - 4}{z^3 + 2z^2 + z}$

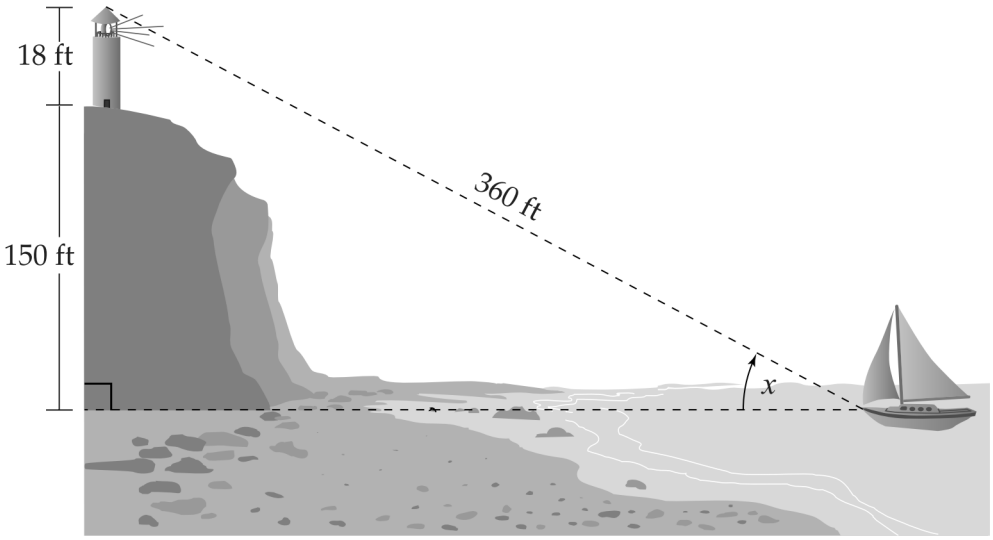
6) Matrices A and B are shown below.

$$A = \begin{bmatrix} -8 & 4 & 3 \\ 6 & -7 & 0 \\ 5 & -6 & 2 \end{bmatrix} \quad B = \begin{bmatrix} -2 & 4 & -9 \\ 1 & 8 & 5 \\ -3 & 4 & 7 \end{bmatrix}$$

Which of the following matrices represent $2A + B$?

(A) $\begin{bmatrix} -10 & 8 & -6 \\ 7 & 1 & 5 \\ 2 & -2 & 9 \end{bmatrix}$ **(B)** $\begin{bmatrix} -18 & 12 & -15 \\ 13 & -7 & 5 \\ 13 & -8 & 11 \end{bmatrix}$ **(C)** $\begin{bmatrix} -18 & 12 & -3 \\ 13 & -6 & 5 \\ 7 & -8 & 11 \end{bmatrix}$ **(D)** $\begin{bmatrix} -20 & 16 & -12 \\ 14 & 2 & 10 \\ 4 & -4 & 18 \end{bmatrix}$

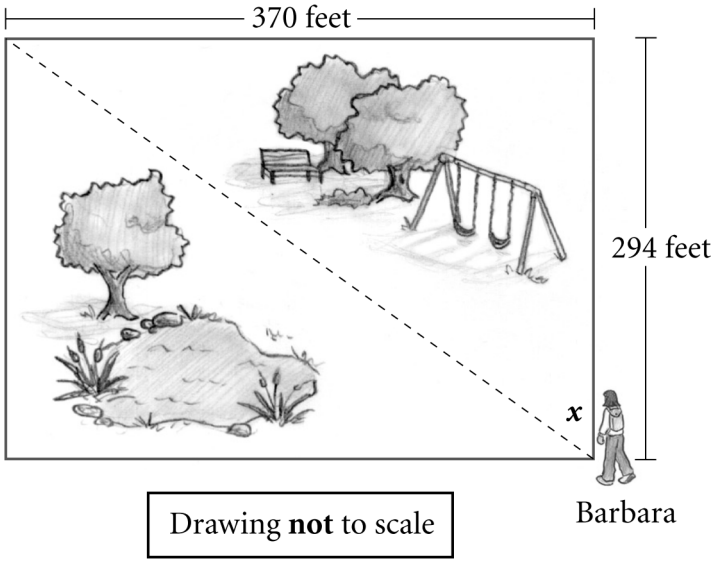
7) A lighthouse, which is 18 feet high, stands on a cliff that is 150 feet above sea level. The distance from the top of the lighthouse to a sailboat on the ocean is 360 feet.



Note: The figure is not drawn to scale.

What is the angle of elevation (x) from the sailboat to the top of the lighthouse? Round the answer to the nearest degree.

8) Barbara went for a walk in the city park. To cut across the rectangular park, she chose the path shown by the dotted line in the drawing below.



At what angle, x, did Barbara cut across the park? Round the answer to the nearest tenth of a degree.

9) Which of these is a factor of the polynomial below?

$9m^2 - 12m + 4$

(A) $3m - 2$ **(B)** $3m + 2$ **(C)** $3m - 1$ **(D)** $3m - 4$

10) Find $\lim_{x\to\infty} \dfrac{2x^2 - 5x + 7}{x^2 - 3x + 4}$.

11) Given: $A = \begin{pmatrix} -5 & 3 \\ 4 & -3 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -1 \\ 0 & 7 \end{pmatrix}$

Which of the following is the sum of $2A + 3B$?

(A) $\begin{pmatrix} -4 & 3 \\ 8 & 15 \end{pmatrix}$ **(B)** $\begin{pmatrix} -16 & 9 \\ 8 & -27 \end{pmatrix}$ **(C)** $\begin{pmatrix} -16 & 9 \\ 12 & 5 \end{pmatrix}$ **(D)** $\begin{pmatrix} -4 & 3 \\ 4 & 4 \end{pmatrix}$

12) In $\triangle ABC$ where C is a right angle, $\sin A = \dfrac{\sqrt{7}}{4}$. What is $\cos B$?

13) Which of the following shows the expression below in factored form?

$x^2 + 2x - 8$

(A) $(x - 2)(x + 4)$ **(B)** $(x + 2)(x + 4)$ **(C)** $(x - 1)(x + 8)$ **(D)** $(x + 1)(x - 8)$

14) For what value of n is $5^n = 625$ true?

15) Which is a factor of $x^2 - 11x + 24$?

(A) $x + 3$ **(B)** $x - 3$ **(C)** $x + 4$ **(D)** $x - 4$

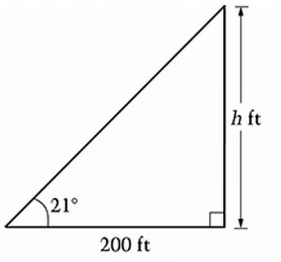
16) $\dfrac{x^2 + 8x + 16}{x + 3} \div \dfrac{2x + 8}{x^2 - 9}$

17) What is the *approximate* solution to the equation $3^{x-1} = 4^{2x+5}$?

18) Find the derivative of $f(x) = x^2$.

19) A lamppost is located 418 feet from a building. The angle of elevation from the base of the lamppost to the top of the building is 32.3°. *Approximately* how tall is the building?

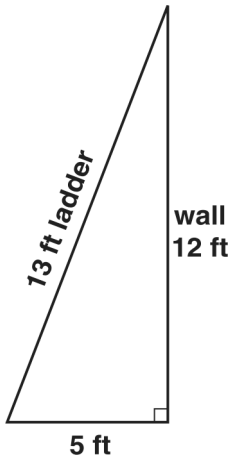
20)



Note: Figure not drawn to scale.

On level ground from a distance of 200 feet, the angle of elevation to the top of a building is 21°, as shown in the figure above. What is the height h of the building, to the nearest foot?

21) A 13-foot ladder is leaning against a brick wall. The top of the ladder touches the wall 12 feet (ft) above the ground. The bottom of the ladder is 5 ft from the bottom of the wall. What is the sine of the angle formed by the ground and the base of the ladder?



22) If $y = 4(1.6)^x$, what is the *approximate* value of x when $y = 12$?

23) The matrix below shows the number of crews a construction company uses per building for three types of buildings.

	Houses	Apartment	Offices
Building Crews	11	45	23
Electrical Crews	3	8	3
Plumbing Crews	4	6	2
Landscaping Crews	1	5	1

The company is currently working on 9 houses, 2 apartment buildings, and 6 office buildings. Which statement is true?

(A) There are more building crews working on offices than on houses.

(B) There are more electrical crews working on apartments than on offices.

(C) There are more plumbing crews working on offices than on apartments.

(D) There are more landscaping crews working on houses than on apartments.

24) A man is standing on level ground 50 feet away from the wall of a building. He looks up at a window on the building. The angle of elevation to the bottom of the window is 28.5°. He then looks up at the top of the building. The angle of elevation to the top of the building is 35°. What is the *approximate* distance between the bottom of the window and the top of the building?

25) What value of x satisfies the equation $\log_3(x - 4) = 2$?

26) If $f(x) = x^3 + 2x^2 + 5$, find $f'(x)$.

27) Matrix R is shown below.

$$R = \begin{bmatrix} -4 & 7 & 9 \\ 6 & -5 & 4 \\ 8 & 3 & -2 \end{bmatrix}$$

Which matrix represents $-6R$?

(A) $\begin{bmatrix} -24 & 45 & 54 \\ 36 & -30 & 24 \\ 42 & 18 & -12 \end{bmatrix}$ **(B)** $\begin{bmatrix} 24 & -42 & -54 \\ -36 & 30 & -24 \\ -48 & -18 & 12 \end{bmatrix}$ **(C)** $\begin{bmatrix} -10 & 13 & 15 \\ 12 & -11 & 10 \\ 14 & 9 & -8 \end{bmatrix}$ **(D)** $\begin{bmatrix} -10 & 1 & 3 \\ 0 & -11 & -2 \\ 2 & -3 & -8 \end{bmatrix}$

28) What value of x makes the equation true?

$$3\begin{bmatrix} 5 & -1 \\ x & 2 \end{bmatrix} - \begin{bmatrix} 4 & 6 \\ -3 & 8 \end{bmatrix} = \begin{bmatrix} 11 & -9 \\ 9 & -2 \end{bmatrix}$$

29) What is the value of z in the solution of this system?

$$\begin{aligned} 2x + 3y + 2z &= 2 \\ x - 4y + 6z &= -25 \\ 3x + 5y - 4z &= 25 \end{aligned}$$

30) Find $\lim_{x \to 2}(x - 5)(x + 3)$.

31) Which expression is the simplified version of $\log x + \log y - k \log r$?

(A) $\log\left(\frac{xy}{r^k}\right)$ **(B)** $\frac{\log(x+y)}{r^k}$ **(C)** $\log(x + y - r^k)$ **(D)** $\log(x + y) - k \log r$

32) Which of the following expressions is equal to $(x + 2) + (x - 2)(2x + 1)$?

(A) $2x^2 - 2x$ **(B)** $2x^2 - 4x$ **(C)** $2x^2 + x$ **(D)** $4x^2 + 2x$

33) What is $4\begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix} - 3\begin{bmatrix} -2 & 6 \\ 3 & 7 \end{bmatrix}$?

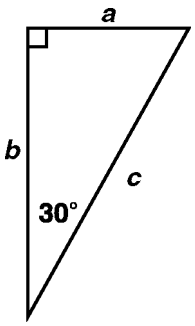
34) Simplify $\frac{6x^2 + 21x + 9}{4x^2 - 1}$ to lowest terms.

35) Which of the following expressions is equal to $\frac{1}{x+2} - \frac{2}{x+1}$?

(A) $\frac{-1}{2x+3}$ **(B)** $\frac{-x-3}{x^2+2}$ **(C)** $\frac{-1}{x^2+3x+2}$ **(D)** $\frac{-x-3}{x^2+3x+2}$

36) Multiply: $3m^2(5m^2 - 6m + 7)$

37) If $a = 3\sqrt{3}$ in the right triangle below, what is the value of b?



38) Use the definition of the derivative to find: $f'(x)$ for $f(x) = x^2 + 2x + 1$.

39) Given the following test scores: 91, 97, 84, 99, 93, 77, 80, 89, 62, 73, and 68. What is the range? What is the standard deviation?

40) Use your calculator to solve the matrix equation $AX = B$, where

$$A = \begin{bmatrix} 2 & -1 & 3 \\ 2 & 0 & -3 \\ 0 & 1 & -2 \end{bmatrix}, \text{ and}$$

$$B = \begin{bmatrix} 7 \\ 11 \\ -5 \end{bmatrix}$$

41) Helen, being honored for bravery, was given a choice of two awards. Which award should she choose?

a) \$2000 in an account paying 7% annually for ten years, or

b) \$100 for the first six months with the award doubling every six months for ten years.

42) Use the quotient rule to find the derivative of: $f(x) = \dfrac{7x - 3}{x^2 + 1}$.

43) Find $\lim\limits_{x \to 2} \dfrac{x^2 - 4}{x - 2}$.

44) What is the remainder when $x^3 - 1$ is divided by $(x + 2)$?

45) If $f(x) = (8x^2 - 19x + 7)^5$, find $f'(0.2)$.

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1.
Answer: 2
Points: 1

2.
Answer:
Points: 1

3.
Answer: $1,238
Points: 1

4.
Answer: $x^2 + 6 + \frac{4}{x-2}$
Points: 1

5.
Answer: $\frac{7(z-2)}{4(z+1)}$
Points: 1

6.
Answer: C
Points: 1

7.
Answer:
Points: 1

8.
Answer: 51.5
Points: 1

9.
Answer: A
Points: 1

10.
Answer: 2
Points: 1

11.
Answer: A
Points: 1

12.
Answer: $\frac{\sqrt{7}}{4}$
Points: 1

13.
Answer: A
Points: 1

14.
Answer: 4
Points: 1

15.
Answer: B
Points: 1

16.
Answer: $\frac{(x+4)(x-3)}{2}$
Points: 1

17.
Answer: −4.797
Points: 1

18.
Answer: $2x$
Points: 1

19.
Answer: 264 feet
Points: 1

20.
Answer: 77
Points: 1

21.
Answer: $\frac{12}{13}$
Points: 1

22.
Answer:
Points: 1

23.
Answer: A
Points: 1

24.
Answer: 7.9 feet
Points: 1

25.
Answer: 13
Points: 1

26.
Answer: $3x^2 + 4x$
Points: 1

27.
Answer: B
Points: 1

28.
Answer: 2
Points: 1

29.
Answer: -3
Points: 1

30.
Answer: -15
Points: 1

31.
Answer: A
Points: 1

32.
Answer: A
Points: 1

33.
Answer: $\begin{bmatrix} 14 & -6 \\ 3 & -5 \end{bmatrix}$
Points: 1

34.
Answer: $\dfrac{3(x+3)}{2x-1}$
Points: 1

35.
Answer: D
Points: 1

36.
Answer: $15m^4 - 18m^3 + 21m^2$
Points: 1

37.
Answer: 9
Points: 1

38.
Answer: $f'(x) = 2x + 2$
Points: 1

39.
Answer: range—37; standard deviation—11.53
Points: 1

40.
Answer: $\begin{bmatrix} 2.125 \\ -9.5 \\ -2.25 \end{bmatrix}$
Points: 1

41.
Answer: second option
Points: 1

42.
Answer: $\dfrac{-7x^2 + 6x + 7}{(x^2+1)^2}$
Points: 1

43.
Answer: 4
Points: 1

44.
Answer: -9
Points: 1

45.
Answer: $-1.213 \cdot 10^4$
Points: 1