

NAME _____

SECTION _____

Exact answers and supporting work are required. Total point count is 180.

CALCULATORS ARE NOT PERMITTED ON THIS EXAM

1. Solve the inequality and write the solution using interval notation. Show work.

[17]

a) $x^2 + 2x > 8$

b) $\left| \frac{3 - 2x}{6} \right| \leq 2$

c) $\frac{2x}{x - 3} \geq 1$

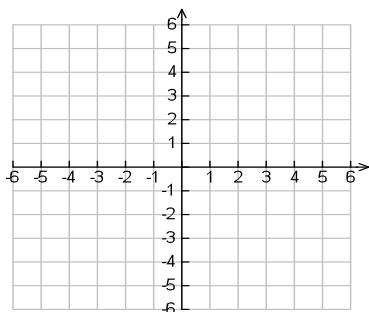
2. Find the standard form of the equation of a circle with center C(20, 15) and passing through the origin.

[3]

3. Find the x- and y-intercepts and sketch the graph.

a) $y = (x - 1)^3(x + 2)^2$

[5]

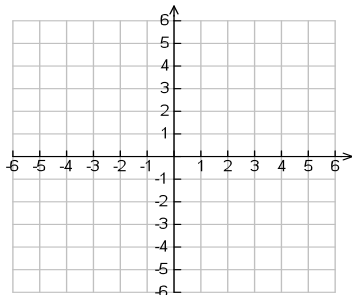


x-int _____

y-int _____

b) $y = 2 - \sqrt{x + 4}$

[4]



x-int _____

y-int _____

4. Find the limit, if it exists $\lim_{x \rightarrow -5} \frac{2x + 10}{x^2 + 7x + 10}$.

[4]

5. Given the functions $f(x) = \frac{3}{x + 2}$ and $g(x) = |x - 5|$, find and simplify the following

[14]

- a) $f(5)$ _____
- b) $f\left(\frac{1}{x}\right)$ _____
- c) $f^{-1}(x)$ _____
- d) $g(f(x))$ _____
- e) Domain using interval notation of $g(f(x))$ _____
- f) $f(g(2))$ _____

6. Compute the derivative $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ of $f(x) = \sqrt{2x+1}$.

[6]

7. Find an equation of the line in slope-intercept form passing through the point (1, 5) and parallel to the line $y = -2x + 1$.

[4]

8. A company wants to construct an open rectangular box (no top) with a volume of 360 in^3 and the length of the base 3 times the width. Express the surface area of the box as a function of the width.

[6]

9. The height (in feet) above the ground of a toy rocket launched upward from the top of a building is given by $s(t) = -16t^2 + 32t + 128$, where t is the time (in seconds) after the rocket was launched.

[8]

a) What is the maximum height attained by the rocket?

b) When does the rocket strike the ground?

10. Find ALL zeros of the polynomial $f(x) = x^3 - 2x^2 - 3x + 4$.

[8]

11. Given that $x = 2i$ is a zero of $f(x) = 3x^3 - 5x^2 + 12x - 20$, find all the other zeros of the function.

[7]

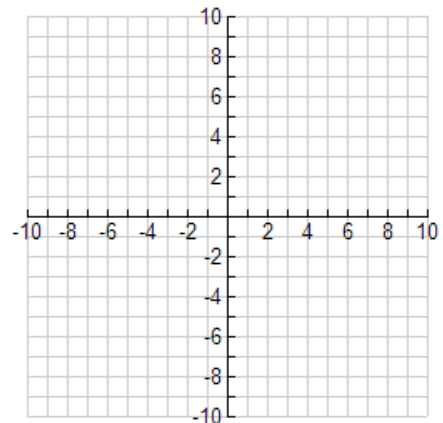
12. Determine the following and sketch an accurate graph of the function

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

on the axes below.

[12]

- a) Domain _____
- b) Range _____
- c) Coordinates of x-intercepts _____
- d) Coordinates of y-intercepts _____
- e) **Equation** of vertical asymptote(s) _____
- f) **Equation** of horizontal or slant asymptote(s) _____
- g) Sketch the graph



13. Given $f(x) = \frac{x^2 + 3}{x}$. Determine if f is odd, even, or neither odd nor even.

[2]

14. Find the exact value of $\sin\left(\frac{\pi}{6} + \frac{3\pi}{4}\right)$.

[7]

15. Find the exact value of the following:

[10]

a) $\sec\left(\frac{4\pi}{3}\right)$ _____

b) $\cot\left(\frac{2\pi}{3}\right)$ _____

c) $\tan^{-1}\left(\tan\left(\frac{5\pi}{3}\right)\right)$ _____

d) $\tan\left(\arccos\left(-\frac{2}{3}\right)\right)$ _____

16. If $\cos x = -\frac{1}{4}$ and $\frac{\pi}{2} \leq x \leq \pi$, find the exact value of the following:

[6]

a) $\cos(2x)$ _____

b) $\tan x$ _____

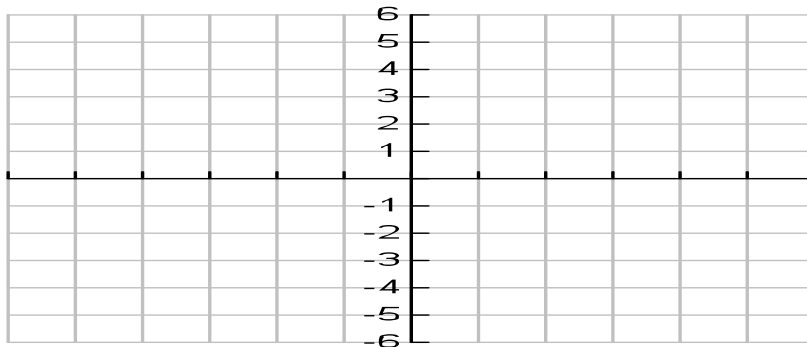
17. Sketch one cycle of the graph of $f(x) = -3\sin(2x + \frac{\pi}{2})$ accurately labeling coordinates on the x-axis and find:

[10]

Amplitude _____ Period _____

Phase shift _____ One cycle begins at _____ ends at _____

State x- and y-coordinates of Local Max _____ and Local Min _____



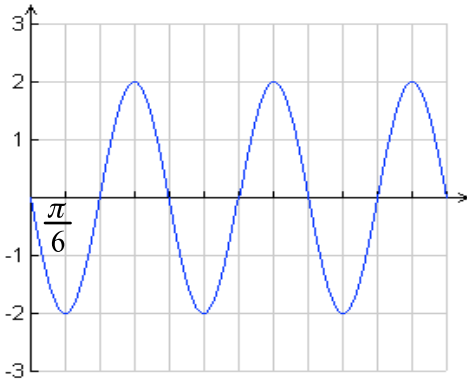
18. Find ALL the solutions in radians that satisfy the given equation.

[8]

a) $\csc t = -2$

b) $2\cos^2 t - \cos t = 1$

19. Find an equation of the **cosine** function whose graph matches the given curve.
[8]

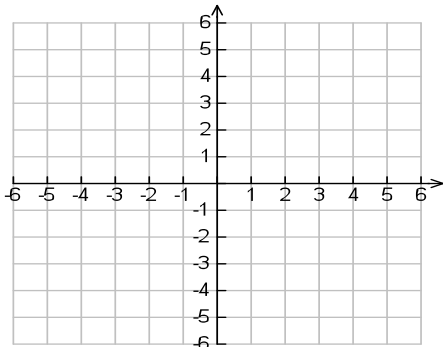


20. Two airplanes leave an airport, and the angle between their flight paths is 40° . An hour later, one plane has traveled 300 miles while the other has traveled 200 miles. How far apart are the planes at this time? Leave your answer in ready to calculate form.
[5]

21. Use the properties of logarithms to expand the expression so that the result does not contain logarithms of products, quotients, or powers.
[5]

$$\ln \sqrt{\frac{x(2x+7)^3}{5y}}$$

22. State the domain, range and asymptote of $f(x) = 1 - e^{x-2}$ and sketch its graph showing any intercepts and asymptotes.
[5]



Domain: _____

Range: _____

Equation of asymptote: _____

23. Give exact solutions.
[8]

a) $\log_3(x+6) - \log_3(x-6) = 2$

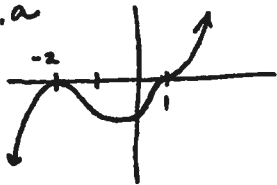
b) $e^{8x-3} = 5^x$

24. The half-life of cesium-137 is 30 years. How long will it take for 10 grams to decay to 2 grams?
[8]

1a. $(-\infty, -4) \cup (2, \infty)$ b. $[-9/2, 15/2]$ c. $(-\infty, -3] \cup (3, \infty)$

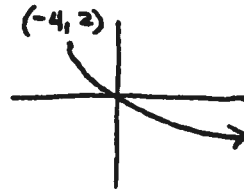
2. $(x-20)^2 + (y-15)^2 = 625$

3.a



x-intercepts:
 $(-2, 0), (1, 0)$
y-intercept:
 $(0, -4)$

b.

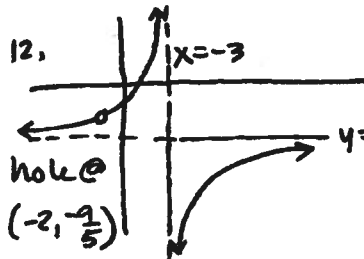


x-intercept: $(0, 0)$
y-intercept: $(0, 0)$

4. $-2/3$ 5a. $3/7$ b. $\frac{3x}{1+2x}$ c. $\frac{3-2x}{x}$ d. $\left| \frac{7+5x}{x+2} \right|$ e. $(-\infty, -2) \cup (-2, \infty)$

5f. $3/5$ 6. $f'(x) = \frac{1}{\sqrt{2x+1}}$ 7. $y = -2x + 7$ 8. $s = 3x^2 + \frac{960}{x}$

9a. 144 ft. b. $t = 4$ sec. 10. $1, \frac{1 \pm \sqrt{17}}{2}$ 11. $5/3, \pm 2i$

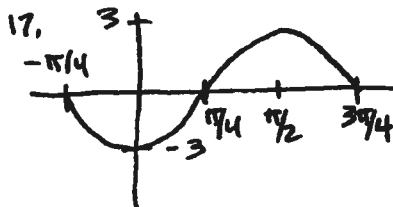


Dom: $(-\infty, -2) \cup (-2, 3) \cup (3, \infty)$
 Ran: $(-\infty, -3) \cup (-3, 9/5) \cup (9/5, \infty)$
 x-intercept $(1, 0)$, y-intercept $(0, -1)$
 VA: $x = 3$ HA: $y = -3$

13. odd

14. $\frac{\sqrt{6} - \sqrt{2}}{4}$

15a. -2 b. $-\frac{1}{\sqrt{3}}$ c. $-\frac{\pi}{3}$ d. $-\frac{\sqrt{5}}{2}$ 16a. $-\frac{7}{8}$ b. $-\sqrt{15}$

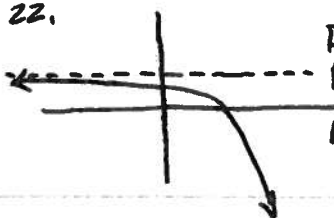


Amplitude = 3 one cycle begins @ $-\pi/4$ max @ $(\pi/2, 3)$
 period = π and ends @ $3\pi/4$ min @ $(0, -3)$
 p. shift = $\frac{\pi}{4}$

18a. $\frac{7\pi}{6} + 2\pi n, \frac{11\pi}{6} + 2\pi n$ 18b. $2\pi n, \frac{2\pi}{3} + 2\pi n, \frac{4\pi}{3} + 2\pi n$ 19. $2 \cos(3x - \frac{3\pi}{2})$

20. $100\sqrt{13-12\cos 40^\circ}$ 21. $\frac{1}{2} \ln x + \frac{3}{2} \ln(2x+7) - \frac{1}{2} \ln y - \frac{1}{2} \ln 5$

22.



Dom: $(-\infty, 0) \cup (0, \infty)$
 Ran: $(-\infty, 1)$
 A.A: $y = 1$

23. a. $15/2$ b. $\frac{3}{8 - \ln 5}$

24. $\frac{30 \ln(15)}{\ln(1/2)}$