Name: _____

Directions: You'll get a copy of the formula sheet (you can also access a copy under Instructor Resources in ALEKS and under Course Documents in Canvas) for each scheduled exam in MATH 1050. In the following, answer the questions for each of the formulas.

1. distance formula: $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
   (a) What does this formula tell us?

   (b) Write down and work an example problem that uses this formula.

   (c) (Optional) How does this formula relate to the Pythagorean Theorem?

2. vertex form of parabola: $f(x) = a(x - h)^2 + k$
   (a) What part of this formula is the vertex?

   (b) What is the vertex of a parabola? It may be helpful to draw a picture of a parabola.

   (c) Rewrite $2x^2 + 12x + 17$ in the form $a(x - h)^2 + k$.

3. $S_n = \dfrac{n(a_1 + a_n)}{2}$; $\quad a_n = a_m + (n - m)d$

   (a) What does the $S_n = \dfrac{n(a_1 + a_n)}{2}$ formula tell us?

   (b) What does the $a_n = a_m + (n - m)d$ formula tell us?

   (c) Find the sum $1 + 5 + 9 + 13 + \cdots + 81$

   (d) Find $\sum_{i=1}^{30}(2i - 3)$

4. equation of a circle $(x - h)^2 + (y - k)^2 = r^2$

   (a) What is the meaning of (h, k) and r from the formula?

   (b) Draw the circle $(x - 2)^2 + (y + 3)^2 = 9$

5. $v = \left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$
   (a) What does this formula give us?

   (b) Use the formula to find the vertex of the parabola $y = 2x^2 + 12x + 17$

6. sum/difference of cubes: $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$; $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$
   (a) What is the difference between these two formulas?

   (b) Factor $8x^3 - 27y^6$

7. average rate of change: $\text{AROC} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$
   (a) This formula looks like another one you're familiar with. What is that other formula?

   (b) Find the average rate of change of $f(x) = x^2 - 3$ from $x = \sqrt{2}$ to $x = 3$.

8. sum/difference identity for sine and cosine:
   $\sin(\alpha \pm \beta) = \sin(\alpha)\cos(\beta) \pm \sin(\beta)\cos(\alpha)$; $\cos(\alpha \pm \beta) = \cos(\alpha)\cos(\beta) \mp \sin(\alpha)\sin(\beta)$
   (a) Under what circumstances would it be helpful to use these formulas?

   (b) Find $\sin(15°)$ using the given formula.

   (c) Find $\cos\left(\frac{7\pi}{12}\right)$ using the given formula.

9. double-angle identities for sine and cosine:
   $\sin(2x) = 2\sin(x)\cos(x)$; $\cos(2x) = \cos^2(x) - \sin^2(x) = 1 - 2\sin^2(x) = 2\cos^2(x) - 1$

   Find $\sin(2\theta), \cos(2\theta)$, and $\tan(2\theta)$ if $\cos(\theta) = -\frac{3}{5}$ and θ terminates in quadrant III.

10. half-angle identities for sine and cosine: $\sin\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1-\cos(\alpha)}{2}}$; $\cos\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1+\cos(\alpha)}{2}}$
    (a) Under what circumstances would it be helpful to use these formulas?

    (b) Find the exact value of $\sin\left(\frac{7\pi}{8}\right)$