Diagnostic – Grade 9 Skills

1.5 hours

This diagnostic reviews the Grade 9 skills that Grade 10 math builds on. Do your best on every question; it is not for marks.

Part A *Fill in the blanks. Answers only.*

1. Evaluate.

a) $3(-4)^2$ = _____

b) $\dfrac{5^{300}}{5^{298}}$ = _____

c) $5\left(\dfrac{3}{4}\right)$ = _____ (as a fraction)

d) $4 - 2(-5)$ = _____

2. Give the equation of the line with slope $\dfrac{3}{2}$ and y-intercept -5. _____

3. State the slope of the line parallel to $y = 5x + 3$. _____

4. State the slope of a line perpendicular to $y = -2x + 7$. _____

5. Find the slope of the line joining the points $A(2,\ 0)$ and $B(0,\ -8)$. _____

6. Evaluate 15% of 350. _____

7. A car depreciates by \$5 000 per year and has an initial value of \$30 000.

a) What does the independent variable represent?

_____

b) What does the dependent variable represent?

_____

c) Write an equation for this relation.

_____

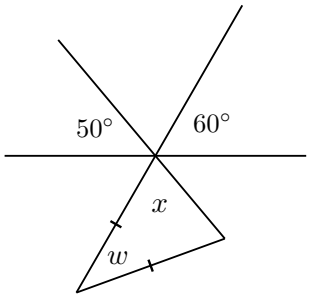
8. State the equation of the horizontal line passing through the point $P(5,\ 7)$. _____

9. Reduce $12 : 24 : 36$ to lowest terms. _____

10. Find the x-intercept of $7x - 3y = -42$. _____

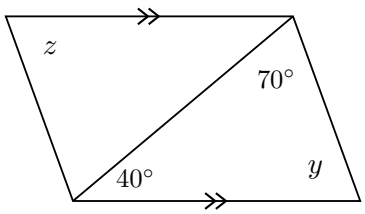
11. State the value of each variable.

a)



$w =$ _____ $x =$ _____

b)



$y =$ _____ $z =$ _____

12. A line has slope $\frac{5}{2}$ and passes through the point $P(1, 3)$. State two other points on the line.

_____ _____

13. The volume of a rectangular prism is 960 cm^3. If the length is 10 cm and the width is 24 cm, then the height is _____

14. A rectangular garden is to be surrounded by 48 m of fencing.

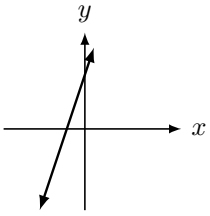
a) State the dimensions in order to maximize the area.

b) State the maximum area.

15. Match each equation to the corresponding graph.

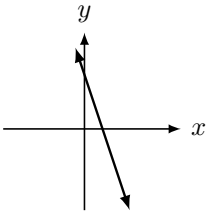
$y = -3x + 2$ $y = 3x + 2$ $y = -3x - 2$ $y = 3x - 2$

a)



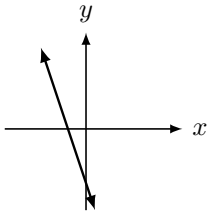
_____

b)



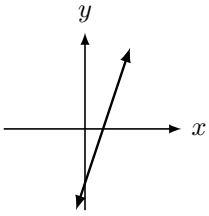
_____

c)



_____

d)



_____

16. Simplify.

a) $(27x^5)(3x^2)$ = _____

b) $\frac{27x^5}{3x^2}$ = _____

c) $(3x^5)^2$ = _____

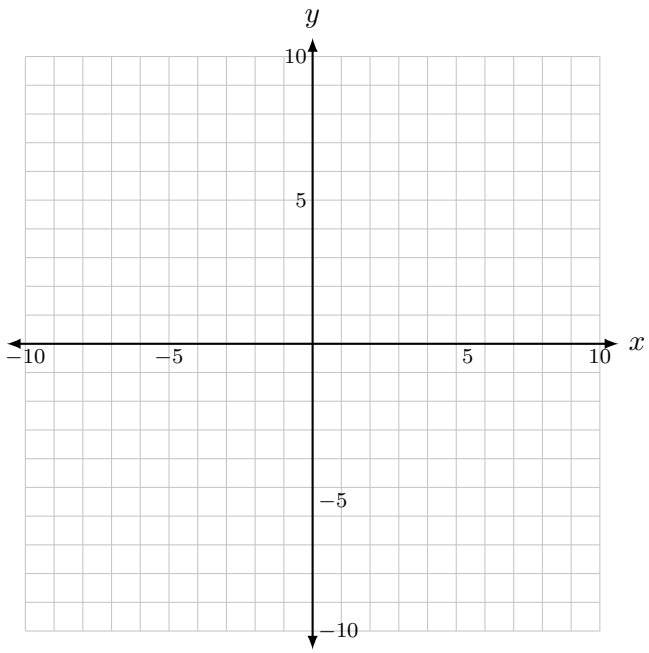
Part B *Give full solutions to all problems in the space provided.*

17. Find the intersection of the following two lines by graphing them on the grid.

a) $2x - y = 8$

b) $y = x - 5$

Intersection point: _____



18. A family is moving from Brampton to Ottawa. Cheap Movers charges \$1750 for 1000 kg or \$2125 for 2500 kg.

a) Find the equation representing the cost of moving using Cheap Movers.

b) Explain the meaning of the slope in this problem.

c) Explain the meaning of the y-intercept in this problem.

19. The length of a rectangle is 3 m more than twice the width. If the perimeter is 42 m, find both the length and the width.

20. Solve the following equations.

a) $5x + 3 = 2x + 16.5$

b) $8(2x + 4) - 3 = 9(x - 3) + 15x$

c) $\frac{4x}{3} + \frac{3x - 2}{4} = \frac{x}{2} - 10$

21. A rectangular floor measuring 15 m by 12 m is to be covered in tiles measuring 0.3 m by 0.3 m. A single box contains 500 tiles and costs $149.95. Find the total cost if taxes are 14%.

22. Evaluate the following.

a) $2(-3) + 4(5)^2 - (-10)$

b) $\left(2\frac{3}{4} - \frac{3}{8}\right) \div \frac{1}{2}$

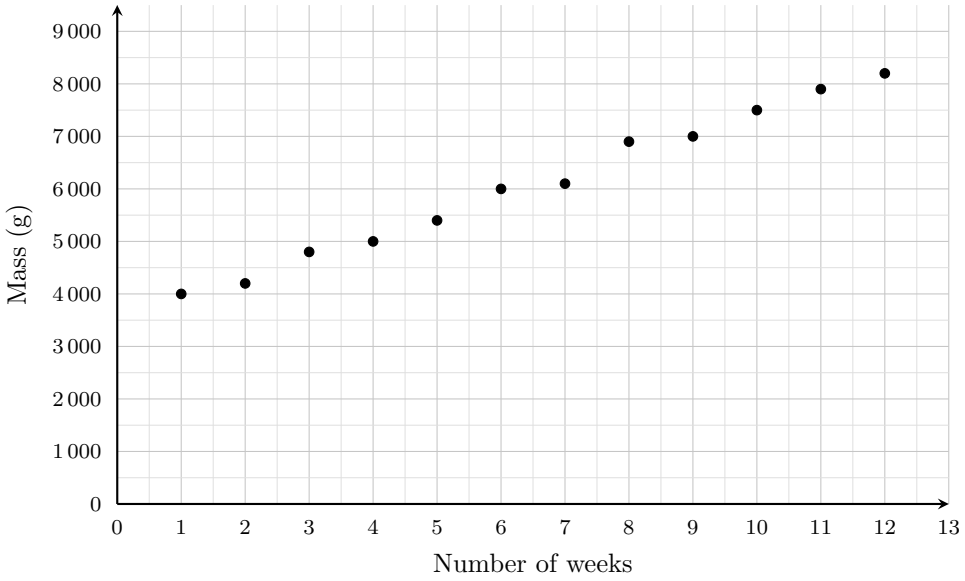
23. Simplify the following.

a) $5(3x - 7y) + 2x - (-x + 8y)$

b) $5x^3\left(2x^2 - y^3\right) + 6x^2\left(x^3 + 3xy^3\right)$

c) $\dfrac{\left(2x^2y\right)\left(-12x^4y^8\right)}{-8x^5y^9}$

24. The mass of a baby was taken at the end of each week for 12 consecutive weeks. These values have been plotted on the grid below.



a) Draw in the line of best fit and extend it to cross the vertical axis.

b) State the initial mass (the y-intercept).

c) Choose another point on your line of best fit. It does not need to be one of the plotted data points.

d) Using the points in (b) and (c), find the slope (rate).

e) Write an equation for this relation.

f) What does the slope represent in this problem?

g) Use your equation in (e) to predict the mass after 15 weeks.

Diagnostic – Grade 9 Skills

Solutions

This diagnostic reviews the Grade 9 skills that Grade 10 math builds on. Do your best on every question; it is not for marks.

Part A *Fill in the blanks. Answers only.*

1. Evaluate.

a) $3(-4)^2$
$= \underline{48}$

b) $\dfrac{5^{300}}{5^{298}}$
$= \underline{25}$

c) $5\left(\dfrac{3}{4}\right)$
$= \underline{\frac{15}{4}}$
(as a fraction)

d) $4 - 2(-5)$
$= \underline{14}$

2. Give the equation of the line with slope $\dfrac{3}{2}$ and y-intercept -5. $y = \frac{3}{2}x - 5$

3. State the slope of the line parallel to $y = 5x + 3$. $m = 5$

4. State the slope of a line perpendicular to $y = -2x + 7$. $m = \frac{1}{2}$

5. Find the slope of the line joining the points $A(2, 0)$ and $B(0, -8)$. $m = 4$

$m = \dfrac{-8 - 0}{0 - 2} = \dfrac{-8}{-2} = 4$

6. Evaluate 15% of 350. 52.5

7. A car depreciates by \$5 000 per year and has an initial value of \$30 000.

a) What does the independent variable represent?
x, the number of years that have passed since the car was bought

b) What does the dependent variable represent?
y, the value of the car, in dollars

c) Write an equation for this relation.
$y = -5000x + 30\,000$

8. State the equation of the horizontal line passing through the point $P(5, 7)$. $y = 7$

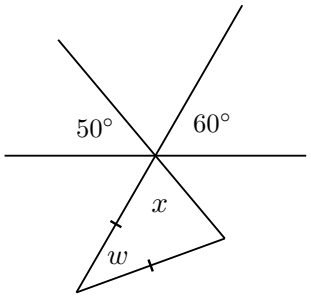
9. Reduce $12 : 24 : 36$ to lowest terms. $1 : 2 : 3$

10. Find the x-intercept of $7x - 3y = -42$. -6

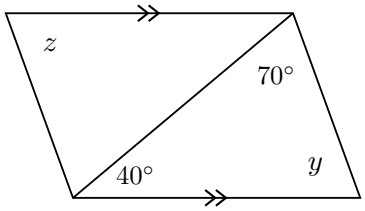
Let $y = 0$: $7x = -42$, so $x = -6$.

11. State the value of each variable.

a)



b)



$w =$ 40° $x =$ 70° $y =$ 70° $z =$ 70°

a) $x = 180° - 50° - 60° = 70°$ (opposite angles); the triangle is isosceles, so $w = 180° - 2(70°) = 40°$.

b) $y = 180° - 40° - 70° = 70°$ (angle sum); $z = y = 70°$ (opposite angles of a parallelogram).

12. A line has slope $\frac{5}{2}$ and passes through the point $P(1, 3)$. State two other points on the line.

(3, 8) (5, 13)

13. The volume of a rectangular prism is 960 cm^3. If the length is 10 cm and the width is 24 cm, then the height is 4 cm $h = 960 \div (10 \times 24) = 4$

14. A rectangular garden is to be surrounded by 48 m of fencing.

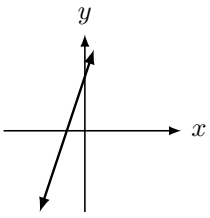
a) State the dimensions in order to maximize the area.
12 m by 12 m

b) State the maximum area.
144 m^2

15. Match each equation to the corresponding graph.

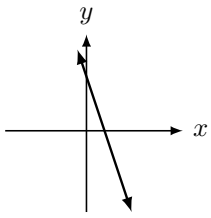
$y = -3x + 2$ $y = 3x + 2$ $y = -3x - 2$ $y = 3x - 2$

a)



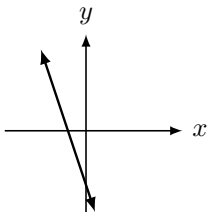
$y = 3x + 2$

b)



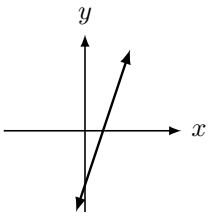
$y = -3x + 2$

c)



$y = -3x - 2$

d)



$y = 3x - 2$

16. Simplify.

a) $(27x^5)(3x^2)$
$= 81x^7$

b) $\frac{27x^5}{3x^2}$
$= 9x^3$

c) $(3x^5)^2$
$= 9x^{10}$

Part B *Give full solutions to all problems in the space provided.*

17. Find the intersection of the following two lines by graphing them on the grid.

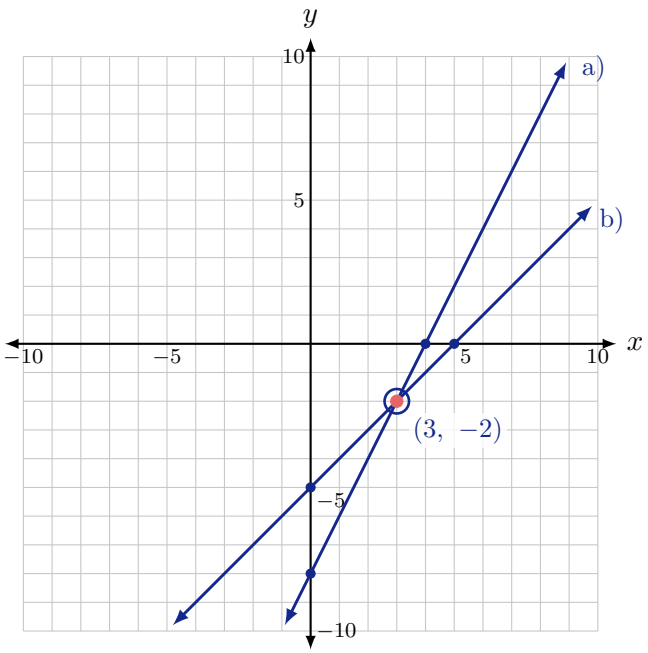
a) $2x - y = 8$

x-intercept: $y = 0,\ 2x = 8,\ x = 4$
y-intercept: $x = 0,\ -y = 8,\ y = -8$

b) $y = x - 5$

slope 1, y-intercept -5

Intersection point: $(3,\ -2)$



18. A family is moving from Brampton to Ottawa. Cheap Movers charges \$1750 for 1000 kg or \$2125 for 2500 kg.

a) Find the equation representing the cost of moving using Cheap Movers.

Let x be the mass moved, in kg, and y be the cost, in dollars. The points are $(1000,\ 1750)$ and $(2500,\ 2125)$.

$$m = \frac{\Delta y}{\Delta x} = \frac{2125 - 1750}{2500 - 1000}$$
$$= \frac{375}{1500} = 0.25$$

Sub $(2500,\ 2125)$ **into** $y = 0.25x + b$

$$2125 = 0.25(2500) + b$$
$$2125 = 625 + b$$
$$2125 - 625 = 625 + b - 625$$
$$1500 = b$$
$$\therefore\ y = 0.25x + 1500$$

b) Explain the meaning of the slope in this problem.

The cost per kilogram moved: each extra kilogram costs \$0.25.

c) Explain the meaning of the y-intercept in this problem.

The fixed cost of hiring the movers (\$1500), charged before anything is moved.

19. The length of a rectangle is 3 m more than twice the width. If the perimeter is 42 m, find both the length and the width.

Let x be the width, in metres.
Then the length is $2x + 3$ metres.

$$\begin{aligned} P &= 2l + 2w \\ 42 &= 2(2x + 3) + 2x \\ 42 &= 4x + 6 + 2x \\ 42 &= 6x + 6 \\ 42 - 6 &= 6x + 6 - 6 \\ 36 &= 6x \\ \frac{36}{6} &= \frac{6x}{6} \\ 6 &= x \end{aligned}$$

Length: $2x + 3 = 2(6) + 3 = 15$

Check: $2(15) + 2(6) = 30 + 12 = 42$ ✓

$\therefore$ the width is 6 m and the length is 15 m.

20. Solve the following equations.

a) $5x + 3 = 2x + 16.5$

$$\begin{aligned} 5x + 3 &= 2x + 16.5 \\ 5x + 3 - 2x - 3 &= 2x + 16.5 - 2x - 3 \\ 3x &= 13.5 \\ \frac{3x}{3} &= \frac{13.5}{3} \\ x &= 4.5 \end{aligned}$$

b) $8(2x + 4) - 3 = 9(x - 3) + 15x$

$$\begin{aligned} 16x + 32 - 3 &= 9x - 27 + 15x \\ 16x + 29 &= 24x - 27 \\ 16x + 29 - 16x + 27 &= 24x - 27 - 16x + 27 \\ 56 &= 8x \\ \frac{56}{8} &= \frac{8x}{8} \\ 7 &= x \end{aligned}$$

c) $\frac{4x}{3} + \frac{3x - 2}{4} = \frac{x}{2} - 10$

Multiply both sides by the lowest common denominator, 12.

$$12\left[\frac{4x}{3} + \frac{3x - 2}{4}\right] = 12\left[\frac{x}{2} - 10\right]$$

$$\begin{aligned} 4(4x) + 3(3x - 2) &= 6(x) - 120 \\ 16x + 9x - 6 &= 6x - 120 \\ 25x - 6 &= 6x - 120 \\ 25x - 6 - 6x + 6 &= 6x - 120 - 6x + 6 \\ 19x &= -114 \\ \frac{19x}{19} &= \frac{-114}{19} \\ x &= -6 \end{aligned}$$

21. A rectangular floor measuring 15 m by 12 m is to be covered in tiles measuring 0.3 m by 0.3 m. A single box contains 500 tiles and costs \$149.95. Find the total cost if taxes are 14%.

Area of the floor

$15 \times 12 = 180 \text{ m}^2$

Area of one tile

$0.3 \times 0.3 = 0.09 \text{ m}^2$

Number of tiles needed

$180 \div 0.09 = 2000$

Number of boxes needed

$2000 \div 500 = 4$

Total cost

$= 4 \times 149.95 \times 1.14$

$= 599.80 \times 1.14$

$= 683.772$

$\therefore$ the total cost is \$683.77.

22. Evaluate the following.

a) $2(-3) + 4(5)^2 - (-10)$

$= -6 + 4(25) + 10$

$= -6 + 100 + 10$

$= 104$

b) $\left(2\frac{3}{4} - \frac{3}{8}\right) \div \frac{1}{2}$

$= \left(\frac{11}{4} - \frac{3}{8}\right) \div \frac{1}{2} = \left(\frac{22}{8} - \frac{3}{8}\right) \div \frac{1}{2}$

$= \frac{19}{8} \times \frac{2}{1} = \frac{38}{8} = \frac{19}{4}$

23. Simplify the following.

a) $5(3x - 7y) + 2x - (-x + 8y)$

$= 15x - 35y + 2x + x - 8y = 18x - 43y$

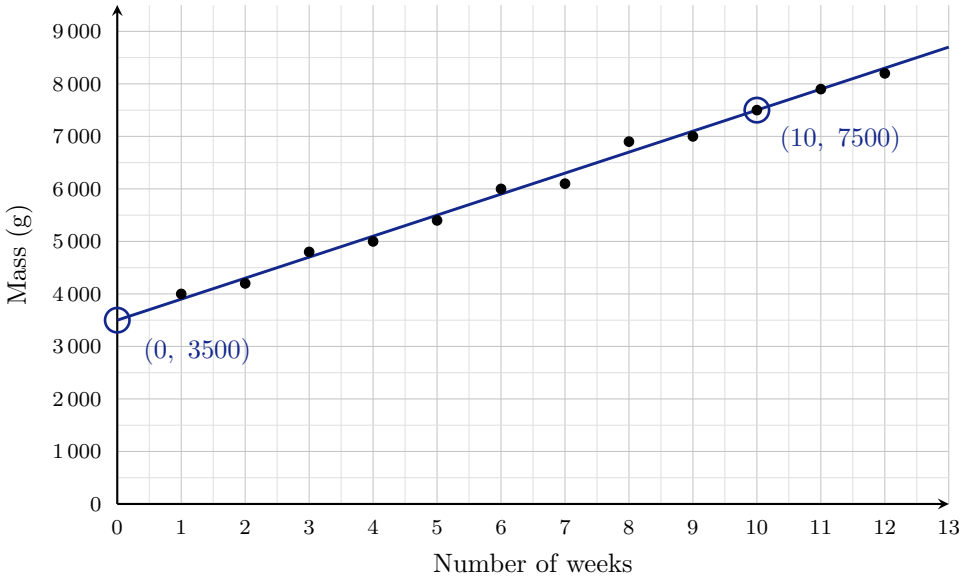
b) $5x^3\left(2x^2 - y^3\right) + 6x^2\left(x^3 + 3xy^3\right)$

$= 10x^5 - 5x^3y^3 + 6x^5 + 18x^3y^3 = 16x^5 + 13x^3y^3$

c) $\dfrac{(2x^2y)\left(-12x^4y^8\right)}{-8x^5y^9}$

$= \dfrac{-24x^6y^9}{-8x^5y^9} = 3x$

24. The mass of a baby was taken at the end of each week for 12 consecutive weeks. These values have been plotted on the grid below.



Answers for (b) to (g) depend on the line of best fit drawn. The line here passes through (0, 3500) and (10, 7500); a line through (0, 3500) and (10, 7000) is also reasonable and gives a rate of 350 g per week and a prediction of 8750 g.

a) Draw in the line of best fit and extend it to cross the vertical axis.

b) State the initial mass (the y-intercept).

3500 g, or (0, 3500)

c) Choose another point on your line of best fit. It does not need to be one of the plotted data points.

(10, 7500)

d) Using the points in (b) and (c), find the slope (rate).

$$m = \frac{\Delta y}{\Delta x} = \frac{7500 - 3500}{10 - 0} = \frac{4000}{10} = 400 \quad \text{(grams per week)}$$

e) Write an equation for this relation.

$y = 400x + 3500$

f) What does the slope represent in this problem?

The mass the baby gains each week: about 400 g per week.

g) Use your equation in (e) to predict the mass after 15 weeks.

$y = 400(15) + 3500 = 6000 + 3500 = 9500$

$\therefore$ the mass of the baby after 15 weeks will be about 9500 g.