Multiple Choice

Circle the best answer for each of the following questions.

1. If $\sin\theta = -\frac{3}{5}$, then

A $\cos\theta = -\frac{4}{5}$ **B** $\cos\theta = -\frac{3}{4}$

C $\cos\theta = \frac{3}{4}$ **D** $\cos\theta = \frac{5}{4}$

2. The period of the function $f(x) = 2\sin[3(x - 60°)] - 1$ is

A $-60°$ **B** $60°$ **C** $120°$ **D** $180°$

3. Jane walks 9 m to the west, and then 40 m to the north. The magnitude of the displacement vector of her walk is

A 7 m **B** 31 m **C** 41 m **D** 49 m

4. $(5x^2y^3)(-3x^4y^5)$ is equal to

A $-15x^6y^8$ **B** $8x^8y^{15}$

C $\frac{1}{125}x^{-2}y^{-2}$ **D** $2x^6y^8$

5. If $4^{3x+2} = 2^{2x-3}$, then the value of x is

A -5 **B** $-\frac{7}{4}$ **C** $\frac{7}{4}$ **D** 5

6. The function $f(x) = x^4 + 2x$

A has point symmetry about the origin

B has line symmetry about the y-axis

C has line symmetry about the x-axis

D has neither point symmetry nor line symmetry

7. If $f(x) = 2x^4 + 3x^2 - 5$, then $f(-2)$ is equal to

A 263 **B** 39 **C** -15 **D** -33

8. The graph of the function $y = -2(x + 3)^4$ intersects the x-axis

A once

B twice

C four times

D does not intersect the x-axis

9. The real roots of the polynomial function $f(x) = x^3 - 5x^2 + 6x$ are

A $-2, -1, 3$

B $-2, 0, 3$

C $-2, 1, 3$

D $0, 2, 3$

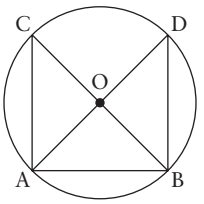
10. If $\angle ACB$ and $\angle ADB$ are inscribed angles subtended by the same chord AB, as shown in the diagram, then

A $\angle ACB = \angle ADB$

B $\angle AOB = 2\angle ADB$

C neither A nor B

D both A and B



11. The magnitude of parallel vectors is

A always the same

B sometimes the same

C never the same

D zero

Short Answer

Write answers to each of the following questions.

12. State the exact values of the three primary trigonometric ratios for 150°.

13. Use a calculator to find each value of θ to the nearest degree, where $0° \le \theta \le 90°$.

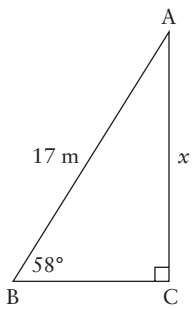
a) $\sin\theta = 0.6128$

b) $\cos\theta = 0.1258$

c) $\tan\theta = 2.2571$

14. Determine the length of the indicated side x for each of the following triangles, to one decimal place.

a)



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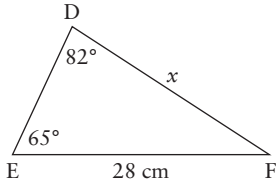

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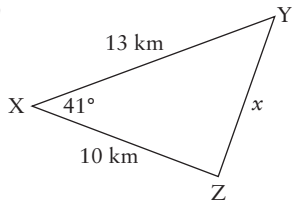


15. Consider the function $y = 2 \sin [4(x + 50°)] - 3$. State the

a) amplitude

b) period

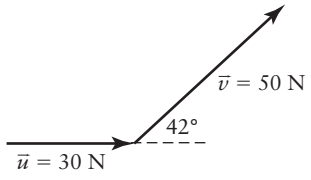
c) phase shift

d) vertical shift

e) domain

f) range

16. Two vectors, $\vec{u}$ and $\vec{v}$, are placed head-to-tail as shown in the diagram.



a) Determine the magnitude of the resultant vector, $\vec{u} + \vec{v}$, to the nearest tenth of a newton.

b) Determine the direction of the resultant vector, $\vec{u} + \vec{v}$, to the nearest tenth of a degree.

17. a) Express 130° as a quadrant bearing.

b) Express N80°W as a true bearing.

18. Evaluate each of the following. Where appropriate, express your answers as fractions in lowest terms.

a) $\left(\frac{1}{25}\right)^{-\frac{1}{2}}$

b) $\left(81^{-\frac{1}{4}}\right)^{3}$

19. If $4^{-x} = \left(\frac{1}{2}\right)^{x+3}$, determine the value of x.

20. Evaluate each of the following.

a) $\log_3 81$

b) $\log_5 \left(\frac{1}{125}\right)$

21. Write $2^4 = 16$ in logarithmic form.

22. Consider the polynomial function $f(x) = 2x^3 - 3x^2 + 5x - 4$.

a) State the degree of the function.

b) State the sign of the leading coefficient of the function.

c) What can you determine about the end behaviour of the function from the degree of the function and the sign of the leading coefficient of the function?

d) What do you know about the values of the third differences for this function?

e) State the domain and range of the polynomial function.

23. Evaluate $f(x) = 2x^3 - 4x^2 + 3x - 1$ for $x = 3$.

24. The area of a rectangle is given by $15x^2 + 26x + 8$. Determine an expression for the perimeter of the rectangle.

25. Calculate the volume, in Canadian gallons, of the water in a cylindrical fish bowl with a diameter of 23 cm and a height of 14 cm, if the bowl is filled to a depth of 12 cm. Round your answer to the nearest tenth of a Canadian gallon.
(Note: 1 L = 1000 cm^3;
4.546 09 L = 1 Canadian gallon)

Extended Response

Write complete solutions to each of the following questions.

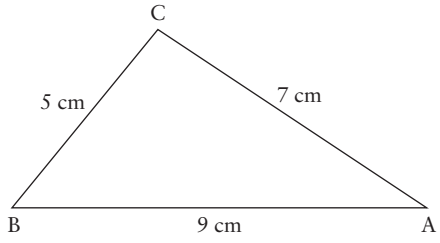
26. The point $(5, -6)$ is on the terminal arm of an angle θ in standard position. Determine the exact primary trigonometric ratios for θ. Then, determine the measure of angle θ.

27. A point on level ground is 20 m away from a point on the ground directly below a horizontal bridge that forms an overpass on a highway. The angle of elevation to the underside of the bridge is 14°.

a) Draw a diagram to represent this situation.

b) Will a truck that is 4.3 m in height be able to pass safely under the bridge if the truck needs to have 0.5 m in clearance? Justify your answer.

28. Solve $\triangle ABC$.



29. a) Describe the transformations on $f(x) = \sin x$ that would result in $g(x) = 3 \sin [2(x - 60°)] + 2$.

b) State the period, amplitude, phase shift, and range of $g(x)$.

c) Graph g(x), showing two complete cycles.

30. Sketch one cycle of each of the following functions. State the period, amplitude, and phase shift.

a) $y = 3 \sin \frac{1}{2} x$

b) $y = 4 \cos [2(x + 45°)] - 1$

31. Raoul is pushing on the handle of a lawn mower with a force of 280 N acting 32° below the horizontal.

a) Draw a diagram to illustrate this situation.

b) Determine the magnitude of the force pushing the lawn mower horizontally, to the nearest tenth of a newton.

c) Determine the magnitude of the force pushing the lawn mower vertically, to the nearest tenth of a newton.

32. A car travels east at 100 km/h for 3 h, and then northeast at 80 km/h for 2 h.

a) Determine the magnitude of the car's displacement, to the nearest tenth of a kilometre.

b) Determine the bearing of the car, to the nearest tenth of a degree.

33. Evaluate $\left(-\frac{5}{3}\right)^{-2} \left[\left(-\frac{125}{27}\right)^{\frac{1}{3}}\right]^2$. Express your final answer as a fraction in lowest terms. Show your steps.

34. a) Solve $2^x = 8$ graphically. Check your answer.

b) Solve $625^{3x+2} = 25^{2x-4}$ algebraically. Check your answer.

35. An investment of \$5000 earns 3.5% interest per year, compounded quarterly.

a) Write an equation to model the amount, A, that the investment is worth as a function of the time, t, in years.

b) How much will the investment be worth after 3 years?

c) If you double the initial investment, does the final amount also double? Show your work.

d) If you leave the investment for double the time, does the amount of interest earned also double? Show your work.

36. State whether the polynomial function $f(x) = 2x^4 - 3x^2 + 6$ is even, odd, or neither. Explain how you know.

37. The population, P, of a town can be modelled by the function $P(t) = 3t^4 - 5t^3 + 80t + 15\,000$, where t is the time, in years, from the present time.

a) What type of function is $P(t)$?

b) Which finite differences are constant for this polynomial function?

c) What is the population of the town now?

d) What will the population of the town be in 8 years?

38. Factor each of the following expressions completely.

a) $5x^2y^3 - 15x^4y^2$

b) $x^2 + 6x - 27$

c) $3m^2 + 22mn + 7n^2$

d) $m^2 + 18m + 81$

e) $2a^3 + 2a^2 - 12a$

f) $25x^2 - 49y^2$

39. a) The volume of a storage chest is modelled by the polynomial expression $x^3 + 5x^2 + 6x$, with the height of the box being the shortest dimension. Determine expressions for the length, width, and height of the box.

b) Determine the dimensions of the box if x is 2 cm.

40. Solve each of the following.

a) $x^2 + 7x + 10 = 0$

b) $6a^2 - 5a - 6 = 0$

c) $12g^2 = -5g + 3$

41. Consider the function $f(x) = -x^3 + 3x^2 - 2x$.

a) State the degree of the polynomial function.

b) Determine the end behaviour of the function.

c) Determine the intercepts of the function algebraically.

d) Use the information from the above to sketch a graph of the function.

42. The formula $SA = 2\pi r^2 + 2\pi rh$ is used to determine the surface area, SA, of a cylinder with radius r and height h.

a) Determine the surface area of a cylinder with radius 3 cm and height 5 cm. Round your answer to the nearest tenth of a square centimetre.

b) Determine the height of a cylinder with surface area 300 m^2 and radius 4 m. Round your answer to the nearest tenth of a metre.

43. a) Determine the length of the arc of a circle with radius 15 m and a central angle of 100°. Round your answer to the nearest tenth of a metre.

b) The central angle of a sector of a circle with radius 20 cm is 65°. Determine the area of the sector. Round your answer to the nearest tenth of a degree.

44. The distance from the centre of a circle to a point outside the circle is 25 cm. The length of the tangent drawn from this point to the circle is 20 cm. What is the length of the radius of the circle?

45. Elena and Lea are planning to paint the living room of their new house. The length of the living room is 22 ft, the width of the living room is 14 ft, and the height of the walls of the living room is 9 ft. They are not planning to paint the ceiling at this time, but they would like to use 2 coats of paint on the walls. Each gallon of paint will cover approximately 32.5 m^2 and costs $54.99. Determine the total cost, before taxes, for the paint they will have to purchase for the living room of their new house. (Note: 1 ft = 0.3048 m)

46. A car is driven from Alvinston 16 km to Watford, then 20 km to Forest, and finally 32 km back to Alvinston, all in a total of 90 min. Explain why the average velocity for the trip is 0 km/h.